AVIATION WEEK

A McGRAW-HILL PUBLICATION

NOV. 21, 1955

50 CENTS

ORDNANCE EXTRAORDINARY! The Terrier, the Navy's new all-weather anti-aircraft missile, is now being produced in quantity by Convair in the Naval Industrial Reserve Ordnance Plant of the U.S. Navy's Bureau of Ordnance. Responsible for supplying our Navy with the most effective weapons, the Bureau of Ordnance participates in vast programs of research, development, testing, and procurement. The Bureau of Ordnance facility at Pomona, California, managed and operated by Convair, is an outstanding example of government and industry working together to produce weapons systems for the defense of our country. CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION

Douglas YC-124B powered by four 5550 h.p. Pratt & Whitney T-34 turboprop engines.

How the Holley "hidden co-pilot" does two jobs with one handle control

Throughout the entire operational range of the new Douglas YC-124B, engine power and propeller governor setting must be precisely coordinated. This has always been a "two-handle" job but in this new airplane the job is done with a single control lever and the help of a Holley Power Control which functions like a "hidden co-pilot".

One of these controls installed on each 5550 horsepower Pratt & Whitney Aircraft T-34 engines automatically senses altitude, air temperature and speed and feeds the information to its nerve center —a series of precision manufactured 3-dimensional cams. These cams continuously interpret this information in terms of engine power which is automatically adjusted through precise metering of fuel by the control.

The Holley Power Control not only coordinates the engine and propeller for all forward thrust conditions but also controls the vital reversing of thrust necessary to reduce the aircraft's landing roll.

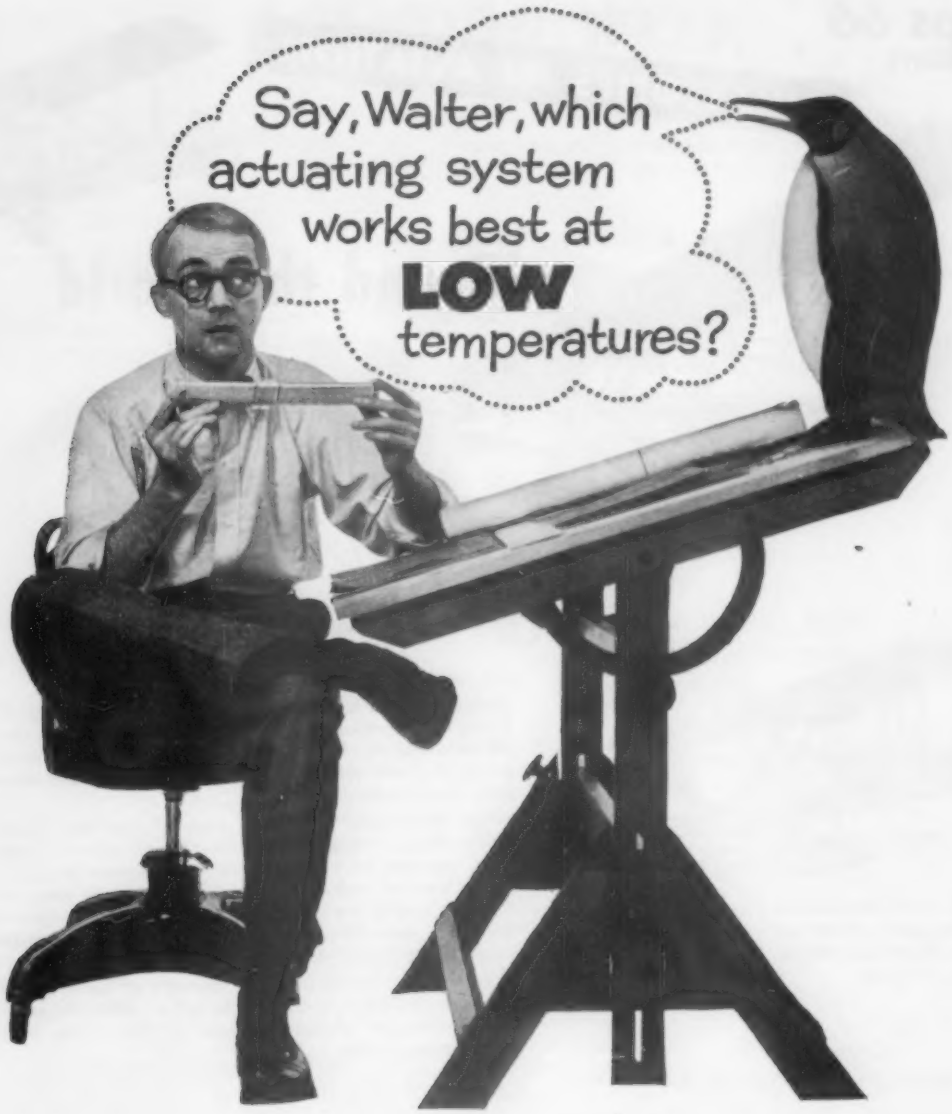
Designed, developed and manufactured by Holley, the "hidden co-pilot" is dependable, easy to service, compact and lightweight—four qualities that always distinguish Holley aviation equipment.

HOLLEY
Carburetor Co.

11955 E. NINE MILE ROAD
VAN DYKE, MICHIGAN

LEADER IN THE DESIGN, DEVELOPMENT, AND MANUFACTURE OF AVIATION FUEL METERING DEVICES

A-22



For fast, efficient performance at temperatures as low as −65°, consider pneumatics! Viscosity of the air used in pneumatic systems remains essentially the same over an extremely broad temperature range. From −65° to +250°, the system is *never* sluggish.

Only pneumatics *stores* energy and delivers it *instantly* when you need it, with no weight penalty. You get *high* horsepower delivery from a *low* horsepower source, with considerable saving in weight. You also save space, since pneumatic systems use smaller lines, with *no* return lines required.

With pneumatics, there is no danger from fire, since the air used in the system cannot burn. And leakage is no serious problem. Air is always available, and the compressor itself will compensate for any minor leaks which might occur.

We here at Kidde have a *complete* line of pneumatic system components, as well as the facilities for engineering complete pneumatic systems. If *you* have a problem in pneumatics, please write us.

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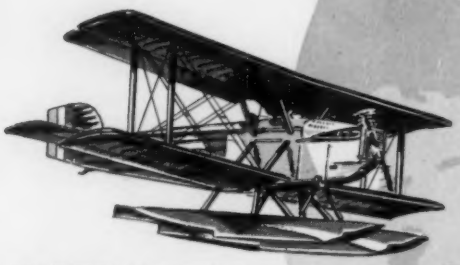
Phillips 66
PRESENTS

MILESTONES IN AVIATION

'Round the World



The DWC's had interchangeable landing gear—floats for over-water flight and wheels for flight over land.

It was on April 6, 1924, that U. S. Army Service pilots, flying four specially built Douglas DWC biplanes, took off from Seattle, Washington, on an attempt to circle the globe. A world-wide organization was set up to service the planes on their mission.

On September 28, 1924, two of the four planes landed back in Seattle. They had flown over 28 countries, covered 26,345 miles in 175 days with a total flying time of 363 hours, seven minutes, to complete the first 'round the world flight. Those who completed the flight were Lieutenants Lowell Smith, L. P. Arnold, Leigh Wade, Erik Nelson, John Harding, Jr.

Twenty-five years later, in February of 1949, a U. S. Air Force B-50 bomber, *Lucky Lady II*, by refueling in the air, circled the globe non-stop—23,452 miles in 94 hours, one minute.

It's Performance that Counts!

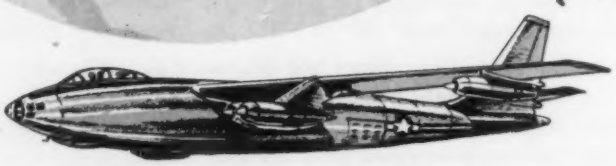
For many years, Phillips *66* aviation gasolines have delivered performance that has resulted in complete satisfaction to operators of military and commercial planes. Phillips Petroleum Company is now producing 115/145 grade aviation gasoline in vast quantities, and is also manufacturing improved fuels for the latest designs in turbo-props and jets.

An important milestone in aviation was established by Phillips with the manufacture of Di-isopropyl and HF Alkylate, two power-packed aviation fuel components of utmost value to modern high-speed performance.

In aircraft fuels it's *performance* that counts. And Phillips *66* products are *outstanding* for performance!

AVIATION DIVISION
PHILLIPS PETROLEUM COMPANY
BARTLESVILLE, OKLAHOMA

Jim Ray



In November, 1954, a B-47 *Stratojet* bomber stayed in the air for 47 hours, 35 minutes and covered 21,000 miles at an average speed of almost 450 miles per hour.

Phillips 66

AVIATION PRODUCTS

NOVEMBER 21, 1955

AVIATION WEEK

VOL. 63, NO. 21

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Aviation Week is served by Press Association Inc., a subsidiary of Associated Press.

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RESEARCH AND MARKETING

Irina Nelidow, Mary Whitney Fenton, Elinore Eisenson.

CAB Liberalizes Irregular Operations..... 12
▶ Carriers get unlimited domestic charter authority; awarded a maximum of 10 scheduled flights each month.

Flight Characteristics of the 707 Airliner..... 21
▶ Tex Johnston, Boeing's flight-test chief, tells how America's first jet airliner handles in flight.

Tacan's Future as Common System in Doubt..... 61
▶ The Air Transport Assn. says lack of channels may force Tacan from Common System scene.

Regional Carriers Win New Western Routes..... 99
▶ Competition is key to Board decision in Denver case; United, TWA, American awarded additional services.

AERONAUTICAL ENGINEERING

USAF Missile, Engine Tests	18
Canadair Area Rules the Sabre	18
Sound Control Improves Engines	26
Solid State Physics Research	25

AVIONICS

Filter Center	69
New Avionic Products	75

EQUIPMENT

Supersonic Reconnaissance	34
Turbopump Requires No Controls	48
Gulf Develops New Piston Engine Oil	50
B-52 Ancillaries Use Pneumatics	53
Off the Line	47
What's New	54
New Aviation Products	77
Also on the Market	81

TRANSPORT

Collision Conference Report	13
ACC Common System Proposal	103
SAS to Order U. S. Jets	103
CAB to Study Interline Policy	103
Rizley Proposes Board Reforms	105
United Flight Sabotaged	105
KLM Orders 8 DC-8s	105
Airline Revenues	107
Capital Promotes Theatre Charters	111
CAB Orders	105
Shortlines	111

MANAGEMENT

End to Renegotiation Urged	15
Atomic Trials Test Dispersal Concept	16
V-2 Defies Defense	17
Hughes Enters Commercial Market	17
Who's Where	9, 96
News Digest	7
Industry Observer	9
Washington Roundup	11
Calendar	8
Letters	83

EDITORIAL

Radioactive Role for CAP	114

58,838 copies of this issue printed

AVIATION WEEK • NOVEMBER 21, 1955 • Vol. 63, No. 21
Member ABP and ABC

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single copies 50c. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $30 a year; $50 for two years; $40 for three years. Second class mail privileges authorized at Albany 1, N. Y. Printed in U. S. A. Copyright 1955 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved. Cable Address: "McGraw-Hill New York". Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.

FACTS

about

NEW DEPARTURE
BALL BEARINGS

New Departure split inner ring bearings are separable, facilitating cleaning, inspection and assembly into the engine. They carry heavy thrust loads from either direction and will also support major radial loads.

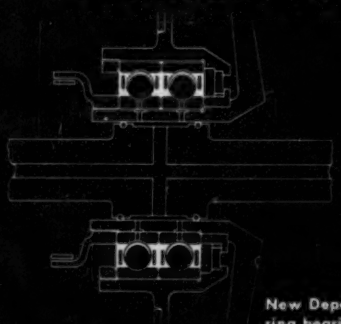
Research develops aircraft bearings for extreme speeds and temperatures

With jet aircraft flying higher and faster than ever before, ball bearings are being called on to meet increasingly severe conditions. For example, bearings that support the turbine wheels are subjected currently to temperatures up to 500° F. at high speeds and heavy thrust loads.

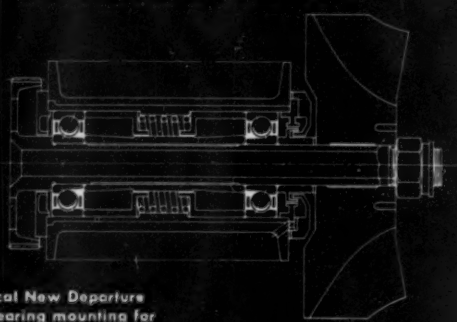
Anticipating still greater demands in the future, New Departure's Aircraft Research Program is already developing bearings for operational speeds of over 100,000 rpm and temperatures moving up towards 1000° F.

Typical of the bearings used in jet engines are New Departure's split inner ring types. These bearings are giving satisfactory performance in production engines today at extremely high speeds and heavy thrust loads. Write for full details.

TYPICAL JET AIRCRAFT APPLICATIONS



New Departure split inner ring bearing mounting for jet engine mainshaft



Typical New Departure ball bearing mounting for alternator drive power turbine

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

NEWS DIGEST

New Sweepback for Vulcan

The second prototype of the Avro Vulcan VX777 has appeared with a re-designed leading edge. Area has been added to the leading edge of the wing to produce a sharper sweepback at the tips. The company said it decided upon the compound sweepback to "make the fullest operational use . . . of more-powerful engines (the Bristol Olympus)" soon to be available

Domestic

U. S. and Canada will construct a new radar warning network stretching from the east coast of Labrador to the southern tip of Newfoundland. The network—one-third of its cost is to be borne by Canada, two-thirds by the U. S.—will be an extension of a radar net being constructed by the U. S. off the Atlantic Coast.

Litton Industries announced that production has started on a low-cost, desk-size digital computer (AW Aug. 22, p. 75) with both commercial and military applications. The computer will sell for approximately $10,000 and can handle "almost any scientific problem aside from data handling."

Hamilton Standard Division of United Aircraft Corp. will become a major source of supply for parts of the Nike surface-to-air missile. Army officials said Hamilton Standard will produce "at least" 50 different parts for the missile, including fins, bulkheads, fittings and housings. Prime contractor for the Douglas Missile is Western Electric Co., Inc.

Elwood R. Quesada, World War II, commander of the USAF's fighter force in Europe, resigned as general manager of Lockheed Aircraft Corp.'s Missile Systems Division at the climax of a dispute with Lockheed executives over design and development procedures. Quesada joined Lockheed after retiring from the Air Force in 1951 with the rank of lieutenant general.

North American Aviation, Inc., signed a technical assistance agreement with Construcciones Aeronauticas Sociedad Anonima (CASA), of Madrid. North American will provide technical advice and help in the repair and overhaul of F-86Fs recently turned over to the Spanish government by the USAF. R. M. Hansen, North American senior representative, and eight other technical advisors will set up classrooms in Spain for CASA employes.

Tomorrow marks the 20th anniversary of the first scheduled flight over a major ocean—the run by Pan American World Airways' China Clipper from San Francisco to Manila via Honolulu.

Financial

Lockheed Aircraft Corp. earnings for the first nine months of the year dropped to $4.73 per share from $6.07 per share for the same period of 1954. Lockheed President Robert E. Gross attributed the lower profits to development costs on two new transport models (the 1649A and the Electra turboprop) and lower military production. Missile Systems Division sales for the nine-month period, however, were more than $16 million, double the volume for the entire year of 1954.

B. F. Goodrich Co. reported net sales for the first nine months of 1955 at $561,924,350, a 20.5% increase over the $466,499,115 registered during the same period of last year. Direct and indirect sales to the U. S. Government amounted to 5.8% of the total net sales. Estimated net income for the nine months amounted to $32,395,212 ($3.66 a common share) after provision for all costs. The same figure for the 1954 period was $27,371,729.

International

The first Canadian-designed guided missile, the Velvet Glove, was placed on display by Canadair for the annual meeting of the Air Industries and Transport Association in Quebec. Canadair reported that the supersonic missile has been successfully fired from F-86 Sabres and Avro CF-100s.

British Ministry of Supply officially announced that two rocket plus turbojet powered interceptors are under development, confirming AVIATION WEEK's report of Nov. 15, 1954, p. 11. The two rocket interceptors are the Saunders-Roe SR-53 and the A. V. Roe Avro-720.

The Fairey Aviation Co. announced that its Fairey Delta 2 research plane attained supersonic speeds in a climb.

Hindustan Aircraft Ltd., manufacturer of the first Indian-built trainer (the HT-2), announced plans to put the aircraft on the international market. Demonstrations of the plane, which is already in operation with the Indian air force, are scheduled for Rangoon, Bangkok, Cambodia, Penang, Kuala Lampur, Singapore and Melbourne.

AVIATION CALENDAR

Nov. 25—Convertible Aircraft Pioneers Third National Congress (invitation only), Franklin Institute, Philadelphia.

Nov. 30-Dec. 2—Air Transport Assn., Airline Finance & Accounting Conference, St. Charles Hotel, New Orleans, La.

Dec. 1—American Astronautical Society, 2nd Annual Meeting, American Museum of Natural History, New York, N. Y.

Dec. 1-2—California Association of Airport Executives Meeting, Paso Robles Inn, Paso Robles, Calif.

Dec. 2-3—Eighth Annual Aviation Conference & Flight Clinic, sponsored by Tucson Chamber of Commerce and Tucson Airport Authority, Tucson, Ariz.

Dec. 6-7—Professional Race Pilots' Assn., convention, Carter Hotel, Cleveland.

Dec. 7-9—National Association of Manufacturers, 60th Annual Congress of American Industry, Waldorf-Astoria Hotel, New York.

Dec. 12-16—Nuclear Engineering & Science Congress & Atomic Exposition, sponsored by Engineers Joint Council, Public Auditorium, Cleveland, Ohio.

Dec. 15-17—Fall Meeting, USA National Committee, URSI (International Radio Scientific Union), University of Florida, Gainesville, Fla.

Dec. 17—Nineteenth Wright Brothers Lecture, U. S. Chamber of Commerce Bldg. Auditorium, Wash., D. C. Wright Day Dinner at Sheraton Park Hotel.

Jan. 9-10—Second National Symposium on Reliability and Quality Control in Electronics, sponsored by Institute of Radio Engineers, Hotel Statler, Washington.

Jan. 9-13—Society of Automotive Engineers, Annual Meeting, Sheraton-Cadillac and Statler Hotels, Detroit.

Jan. 19-21—National Simulation Conference sponsored by Dallas-Fort Worth Chapter of Institute of Radio Engineers' Group on Electronic Computers, Dallas, Tex.

Jan. 23-26—Institute of the Aeronautical Sciences, 24th annual meeting, Sheraton-Astor Hotel, New York, N. Y. **Jan. 23**—Honors Night Dinner.

Jan. 23-26—Plant Maintenance & Engineering Show and Conference, Convention Hall, Philadelphia.

Feb. 2-3—National Symposium on Microwave Techniques, sponsored by Institute of Radio Engineers' Antenna & Propagation Group and Theory & Techniques Group, Philadelphia.

Feb. 7-9—Society of the Plastics Industry, 11th annual Reinforced Plastics Div., conference, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

Mar. 19-21—Society of Automotive Engineers, national production meeting and forum, Hotel Statler, Cleveland, Ohio.

Apr. 9-12—Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum and aircraft engineering display, Hotel Statler, New York, N. Y.

May 2—Society of Aeronautical Weight Engineers, 14th annual conference, Fort Worth, Texas.

May 14-17—First Design Engineering Show, Convention Hall, Philadelphia. Managed by Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

NEW! WNH CLAMP

Presenting the latest member of the famous Monogram family of sheet metal clamps . . . the WNH or Wing Nut Hexagon Clamp. For use where extremely strong tension is required.

Installation of the WNH is **far** faster because of the free-spinning action of the bar-type wing nut. Stronger hexagonal body permits use of holding tools. In sizes for drill holes from .096" to .197" and material thickness from 0" to 1". Send coupon for catalog and name of your nearest Monogram representative.

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Please send catalog on WNH Clamp and other Monogram Clamps.

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WHO'S WHERE

In the Front Office

Maj. Gen. Alden R. Crawford (ret.) elected vice president of European operations for Republic Aviation Corp. **Robert E. Minton** will fill Crawford's former position as general manager of Republic Aviation International.

Ellis D. Slater, president of Frankfort Distilleries Inc., named board member of Emery Air Freight Corp.

Donald A. Voorhees, vice president and general manager of Sierracin Corp., Burbank, Calif.

Fred O. Hosterman, vice president-sales of Western Hydraulics, Ltd.; **Harvey F. Gerwig,** vice president-engineering.

Mark MacIntosh, vice president-merchandising of Traid Corp., Sherman Oaks, Calif. Other changes: **James W. Bontems, Jr.,** vice president-operations; **Howard E. Freeman,** assistant treasurer.

Honors and Elections

Dr. Barry G. King, Stanislaw Krzyckowski and **Francis L. Moseley** received 1955 Flight Safety Foundation awards at the Annual Safety Seminar for distinguished service in achieving safer utilization of aircraft.

Dr. Hugh L. Dryden, director of the National Advisory Committee for Aeronautics, recipient of the Wright Brothers Memoral Trophy for 1955 administered by the National Aeronautical Association.

J. L. Atwood, president of North American Aviation, Inc., received the Commander of Merit decoration of the Republic of Italy for outstanding contribution to aviation.

Arthur F. Kelly, vice president-sales for Western Air Lines, will head the national Air Traffic Conference when he takes office as president for 1956. **Rex Brack** of Braniff International Airways will serve as first vice president and **John Clemson** of Trans World Airways as second vice president.

James E. Sullivan received the Distinguished Civilian Service Award, the Navy's highest civilian honorary award, for former service as director of the Airborne Equipment Div. of the Bureau of Aeronautics.

B. R. Fondren, vice president-finance of Menasco Manufacturing Co., Burbank, Calif., and **Norman T. Rockel,** Tucson controller of Hughes Aircraft Co., have been elected to membership in the Controllers Institute of America.

Changes

Robert L. Griffith, assistant to the president of Delta Air Lines.

William A. Reilly, assistant to the president of H. M. Sawyer & Son Co.

Kenneth L. Snover, assistant to the vice president-manufacturing of International Business Machines Corp.

Robert D. Brown, assistant secretary-treasurer of Fairbanks, Morse & Co.

Bruce C. McLean, legal counsel and asst. secretary of Mohawk Airlines.

(Continued on page 96)

INDUSTRY OBSERVER

► Lockheed has offered Capital Airlines an Electra turboprop transport powered by Rolls-Royce RB 109 engines. Payment terms are considered very favorable for Capital. The RB 109 is rated at 4,470 eshp. compared with 3,750 eshp. of the Allison 501 engines which will be used in the Electras ordered by American Airlines.

► Convair is stepping up its sales program abroad for its Metropolitan transport through an education program of the single-engine performance of its twin-engine plane. Convair feels the Metropolitan is ideally suited for intra-Europe traffic. Present sales backlog of Convair transports will keep it in production for at least another year.

► England has abandoned its project for a long range jet transport with the cancellation of orders for the Vickers Armstrong V-1000. This means the first jet transport capable of non-stop transatlantic operations will be the Boeing 707 or the Douglas DC-8.

► Orenda Engines' PS-13 turbojet, rated at 20,000 lb. sea level static thrust, has completed more than 130 hr. of test stand running. Lack of altitude test facilities in Canada has forced Orenda to ask NACA's Lewis Lab for test time.

► U.S. Air Force F-86D squadrons in England are still the backbone of Britain's all-weather defense. Operational use of the Sabre, controlled by the RAF Fighter Command, pointed up the effectiveness of single-seat formula and contradicted official RAF arguments on the unsuitability of such aircraft for British defense.

► Bristol Aircraft Co. is completing work on the Bristol Freighter as soon as possible and moving a substantial part of its staff working on helicopters to temporary quarters in order to concentrate on production of the Bristol Britannia. British Overseas Airways Corp. is not expected to start scheduled service with the Britannia 100 series before next August. One problem has been lack of success in carrying out de-icing tests on the aircraft.

► First evaluation of the Gloster Javelin night fighter in simulated combat was judged satisfactory by the Royal Air Force. Two Javelins, operating in a defense exercise, intercepted and "destroyed" their Canberra targets 100 miles off the British coast.

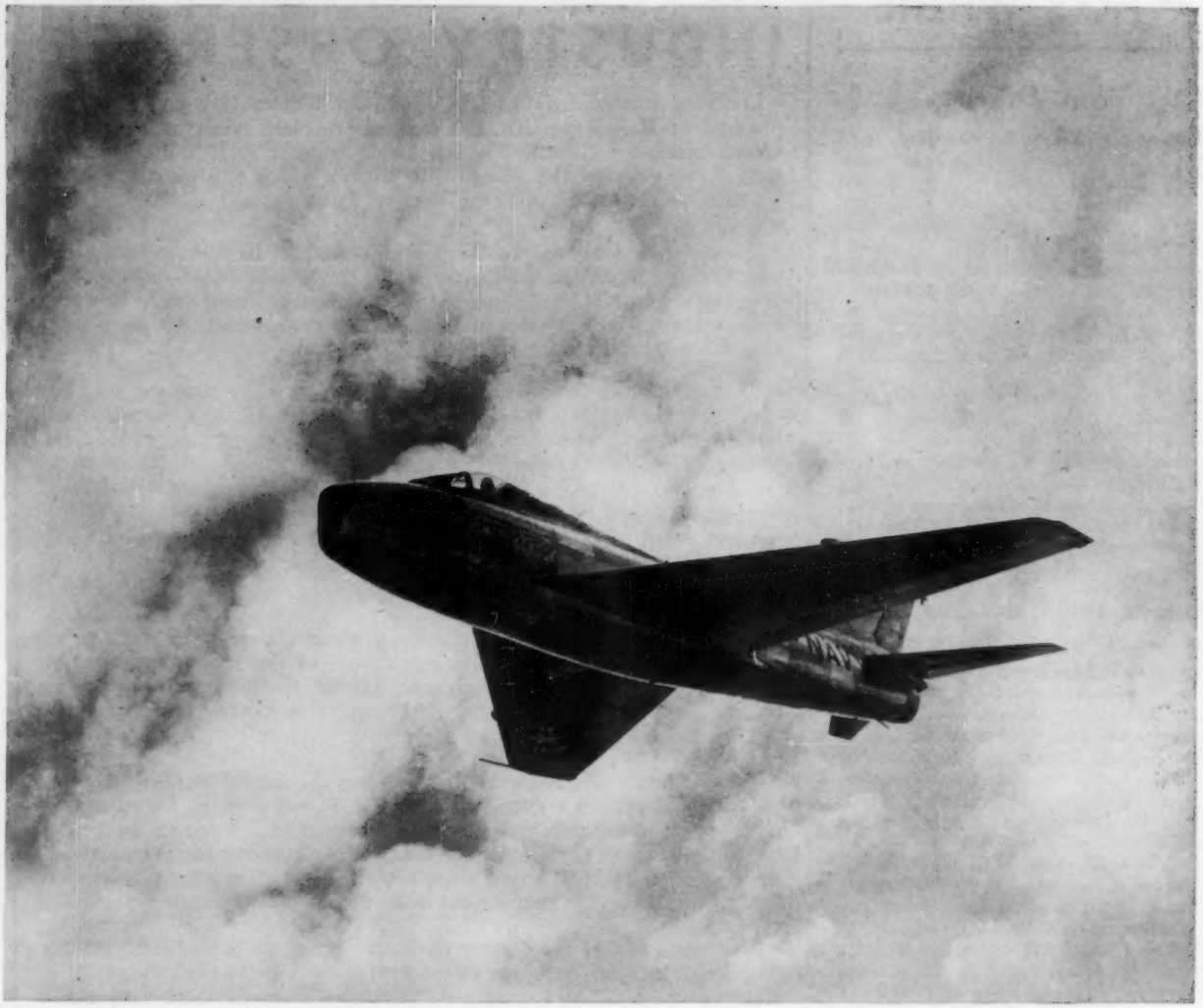
► Strategic Air Command is marking the tails of its Boeing KC-97 tankers with different colored Grimes lights so that each B-47 at a night refueling rendezvous can be assigned to hook up with a tanker marked by a specific color. Object is to avoid mid-air collisions similar to one which occurred over the Gulf of Mexico when two B-47s closed on the same red-lighted tanker and collided. One bomber exploded and was lost.

► Performance of the 30-mm. Aden cannon, standard armament for the RAF Hunter, is still unknown. Very little tactical firing has been done with the weapon. Informed sources believe Neville Duke's accident in a Hunter occurred during firing tests with the Aden cannon.

► First heavy aluminum extrusion press built in the U. S. is now in operation at Kaiser Aluminum & Chemical Co.'s Halethrope, Md., plant. The 80,000-ton press, built by Loewy-Hydropress, Inc., is the first of two that Kaiser will operate under the Air Force heavy press program.

► Investigators of the House Armed Services Investigating Subcommittee are looking into complaints of Navy pilots that the Grumman F9F-7 Cougar is under-powered and dangerous to fly. The aircraft is powered by the Allison J33 turbojet.

► Hamilton Standard propellers continue to be considered for use on the Lockheed Electra turboprop transport which is powered by four Allison 501 engines.



TITANIUM speeds the Fury's flight...

North American's FJ-4, latest of the Fury series of Navy jets, flies with vital parts made of titanium—from nose to tail. For this fastest of the Furies has a heritage of titanium.

It was because of titanium's high strength-weight ratio . . . its corrosion resistance in sea air . . . its freedom from stress-corrosion cracking that titanium was specified for the FJ-2 and the FJ-3. It was the production experience and the performance of REM-CRU titanium alloy parts under the rugged conditions of supersonic flight that led to the further use of REM-CRU C-110M and C-130AM for primary fuselage frames and stiffeners, webs, angles and wing spar fitting on the FJ-4.

REM-CRU, pioneer in titanium alloys for aircraft applications, has expanded production facilities for sheet, strip, plate, bar, wire and tubing. This means your selection of size, shape and alloy grade can be delivered on schedule for your requirements. And REM-CRU engineers are always ready to assist with the application and fabrication of titanium.

To keep abreast of the latest developments on this vital metal, write to Dept. AW6 for the Rem-Cru Review—a free periodical presenting the latest technical data on titanium alloys.

REM-CRU TITANIUM

REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA

Washington Roundup

Shrinking ATA

Plans for shrinking rather than expanding the Air Transport Assn. have been laid down by Harold L. Pearson, ATA president. Pearson wants to show the member airlines a return on their ATA investment. ATA has an annual budget of about one tenth of 1% of the industry's billion dollar gross revenue.

Pearson's first proposal has been to recommend the discontinuance of the four ATA regional operations offices at New York, Kansas City, Fort Worth and Los Angeles. He contends these offices should be closed because they perform no useful function and are expensive.

Travel funds for the ATA staff, which are regularly appropriated by the board of directors, have been sharply cut by Pearson for the last two months of 1955. He also has abandoned plans to move from ATA's cramped, converted apartment office building because he expects personnel reduction in ATA staff to relieve the congestion.

The only staff addition included in Pearson's plans is to hire Herbert B. Warburton as a vice president to head a new state affairs department. Warburton, formerly a one-time Republican congressman from Delaware, is now serving in a congressional liaison capacity for Secretary of Labor James P. Mitchell.

These changes are among those to be proposed by Pearson at the regularly scheduled semi-annual ATA board of director's meeting Dec. 15.

Leaks at CAB

A series of information leaks on confidential Civil Aeronautics Board matters is causing increasing concern to Chairman Ross Rizley. The latest incident centered around the Denver Service Case, details of which were common conversation in the airline industry before the decision became public. One Denver newspaper published a detailed and accurate account of the routes awarded in the decision several days before it was released.

Rizley has repeatedly warned CAB personnel about such security lapses since he took office eight months ago. The Federal Bureau of Investigation may be called in if there is another leak on an important CAB matter.

Rizley apparently also is concerned over the pressures applied by the airlines in less than judicial efforts to influence the Board and its staff in their treatment of route cases and other matters. The situation has come to a head over activities in connection with the important Southwest-Northeast Case.

The chairman is reported to have warned the Air Transport Assn., and thus the industry, against pressure tactics. Apparently Rizley feels the industry should take responsibility for policing itself and has suggested it adopt measures for policing its own actions.

Navy Airlift Study

Navy has renewed efforts to improve its supply system by increased use of airlift, including expanded operations with commercial contract air carriers. A study has been ordered by James H. Smith, Assistant Secretary of Navy for Air, to take a critical look at the present and future requirements in the supply system. This study is being handled in the Office of the Chief of Naval Operations. It will follow along the lines of a study done by Harvard University for the Air Force, which resulted in USAF's present logair operation for speeding its supply system.

Much Ado

A new congressional investigation of State Department "favoritism" to foreign airlines, promoted by National Airlines, is likely to fizzle.

A. G. Hardy, National's senior vice president, belatedly noted that six Convair Liners, on Air Force order, had been sold to Saudi Arabian Airlines and thought it would have been preferable if the deliveries had been made to National instead.

The facts seem to indicate that there is little to investigate:

• **In February** Saudi Arabian indicated an interest in new Convairs for the high traffic period from June to August, when Mohammedans make their religious pilgrimage to Mecca. Convair, State Department and Air Force decided—to their mutual satisfaction—to turn over Convairs on Air Force order to the Arabian carrier. It amounted to delayed delivery on USAF's Convair quota.

• **The Convairs** were delivered to Saudi Arabian in May and June. Convair welcomed the additional business. State Department, noting that other carriers in the Middle East area are ordering British aircraft, welcomed the influx of U. S. equipment.

• **In September,** National placed a $4 million order for six Convairs for delivery in mid-1956. Anxiously wanting new equipment, National heard of the Arabian arrangement in November, and Hardy made his public complaint that National should have been given an opportunity to acquire the USAF allocation. Convair, though, had issued a press release on the Arabian arrangement on Apr. 7—four months before National decided to buy.

Hardy is forwarding a memorandum detailing National's objections of "favoritism" to a foreign carrier to the Senate Commerce Committee. But even National spokesmen commented that their complaint "has been blown up out of proportion."

R & D to Small Firms

Count on the House and Senate Small Business Committees to bring increasing pressure on Defense Department to channel more research and development contracts to small firms.

The new Small Business Administration Act, which became effective Aug. 1, requires the department to report monthly to Congress on the division of research and development work between larger firms and small firms of under 500 employes.

Rep. Wright Patman (D.-Tex.), chairman of the House Small Business Committee, irate over the reports for July and August showing that less than 5% of military research and development contracts are going to small firms, wrote to Defense Secretary Charles Wilson:

"The $1.5 billion a year for (military) research and development work . . . represents a vast subsidization of industrial research. . . .

"These funds handed out to private business firms are in a large sense outright gifts. The new product and process discoveries resulting even from those projects which are thought in advance to be purely of military usefulness turn out, as a general rule, to have valuable commercial application. . . ." **—Washington staff**

AVIATION WEEK VOL. 63, NO. 21
NOVEMBER 21, 1955

CAB Liberalizes Irregular Operations

Carriers get unlimited domestic charter authority; awarded maximum 10 scheduled flights each month.

By Craig Lewis

Washington—A new, liberal approach to regulation of non-scheduled airlines has emerged from the four-year-old Large Irregular Case. Civil Aeronautics Board has established a clear set of rules for nonscheduled operations, ending a ten-year period of confusion and indecision.

The Board renamed the irregular air carriers as Supplemental Air Carriers and drew clear lines of authority for their operations. Members Chan Gurney and Harmar Denny dissented sharply with the majority over permitting some scheduled flights by the irregular carriers.

While the Board finishes its examination of individual carriers on their merits, 49 of them are authorized to operate under the new rules through a blanket exemption until the Board decides on a final form of operating authority and rules on individual qualifications. The four carriers of the North American Airlines group are not included in the exemption.

Here are the new Supplemental Air Carrier regulations:

- **Carriers have unlimited** charter authority for passengers and cargo in domestic, overseas and territorial operations.
- **Charter authority is granted** for cargo operations only in international services.
- **Individual ticket** and waybill operations can be scheduled for up to 10 flights a month in one direction between any two points.

Irregulars Praised

The decision, effective Jan. 1, 1956, generally goes beyond the recommendations of the two examiners in the case (AW Apr. 4, p. 12), the largest the CAB has ever handled.

The unlimited authority for passenger and cargo charter operations doesn't apply to Alaska. Passenger charters in international operations will be permitted, but they will have to be approved on an individual basis under the CAB transatlantic charter policy which is the current practice.

The CAB majority is liberal in its praise of the past accomplishments of the irregular carriers. They said the nonscheduled airlines are currently making a substantial contribution to the national defense through the large volume of work they do for the Department of Defense. The CAB also pointed to the airlift provided by the irregulars in the Berlin and Korean emergencies as proof of their military potential.

In domestic operations, the Board found that the irregulars have filled a public need for air service in periods and places where certificated carriers can't provide it.

"Aside from helping to meet the immediate travel needs of the public," the majority said, "the irregular air carriers have played a significant role as innovators in air transportation. It was they who made an invaluable contribution to air transportation by risking their own capital to pioneer in and develop the field of low-cost coach-type air transportation. And it was largely as a result of such successful experimentation that the certificated trunkline carriers became participants in this field."

Overflow Traffic

The Board concludes that the record of the irregulars shows they are a significant part of the air transport system and that Board policy should be directed toward "their survival and continued healthy growth."

The new class of Supplemental Air Carriers is primarily intended to provide types of service the scheduled airlines either cannot or do not want to provide. They also are intended to take the overflow of traffic the scheduled carriers can't handle at peak traffic periods.

The CAB rejects the recommendations of the examiners on charter authority as too restrictive. Under the new policy, Supplemental Air Carriers will be able to operate unlimited charter flights in the U. S., carrying cargo in competition with the scheduled cargo lines and passengers in competition with the scheduled airlines.

International Charter Limit

A simple plane-load restriction is placed on the supplemental charter authority. A carrier will not be able to charter less than a full airplane capacity, but it will be able to charter an airplane to a group of individuals who are pro rating the total fare among themselves.

In order to maintain its present close regulation of charters between the U. S. and foreign points, the Board will continue to require that approval be asked for each individual charter.

The standard of approval will continue to be the transatlantic charter policy adopted last May.

The limitation of supplemental international charter operations is designed to protect the operators from conditions which they don't meet in domestic operations. But this limitation, along with the exclusion of the ten flights-a-month type of service, is

CAB Approves Two Exchange Operations

Washington—Air charter clearing house operations by two irregular carrier groups have been approved for an experimental period by the Civil Aeronautics Board.

The CAB will allow Aircoach Transport Assn. and the Independent Military Air Transport Assn. to operate their proposed air exchanges domestically for three years.

Four IMATA members—Slick Airways, Flying Tiger Line, Seaboard & Western Airlines, Aerovias Sud Americana—are excluded from the clearing house operations designed to concentrate sales and scheduling of charter flight of irregular carriers in two central agencies.

For the first year, the air exchanges will be subject to numerical limitations. Each exchange will be able to operate one passenger charter flight in each direction between any two points with DC-4 or larger aircraft, two flights with C-46, Martin or Convair aircraft, and three passenger flights with DC-3 equipment.

All charters must be made on a plane-load basis and must be operated by carriers which do not hold a certificate of public convenience and necessity.

Exchange membership has to be open to any irregular carrier. Control of aircraft and crews involved and responsibility for maintenance and safety remains with airline.

Dissenting CAB members Harmar Denny and Chan Gurney said that the exchanges will inhibit bidding and free selection in the form the majority has approved.

also designed to protect U. S. flag operators which are still costing the CAB $25 million a year in subsidy.

The Board figures that the international cargo business has a tremendous untapped potential and has given the irregulars unlimited cargo charter authority in that field.

The controversial part of the decision lies in the new 10 flight limit between points. Along with this numerical standard, the carriers are released from the current prohibitions against flight regularity, so they will now be able to operate what amounts to limited scheduled operations.

The CAB is careful to prohibit any pooling of services which might result in a network operation of the type run by North American and other aircoach operators.

Authority Clarified

The present restrictions against regularity were adopted to protect trunkline carriers, which were then on subsidy, from undue competition. The Board finds that under present conditions the restriction has outlived its usefulness.

According to the majority opinion, the irregular carriers have not been given a new authority so much as they have had their present authority clarified and simplified. Currently, individual sale flights between points are governed by a sliding standard that varies from eight to 12 flights a month, and they must be judged on this variable scale for regularity. Under the new rules, a standard yardstick of 10 flights is applied with no regularity restrictions.

Future Possibilities

The CAB says that the hard facts of economic realism will keep the irregular carriers from using the 10 flight rule to initiate a large scheduled operation.

More modern equipment and vastly superior schedules are expected to maintain the position of the certificated carriers.

If the 10 flight maximum turns out to be excessive, CAB will reopen the case and reduce the maximum to a reasonable level.

The new Supplemental Air Carriers will have their operating authority revoked if reports indicate they have not operated revenue flights in two consecutive quarters. This is a move to prevent violators whose authority has been revoked from reentering the airline business by purchasing an idle operating authority.

The Board held out a possibility of future certification for irregulars by establishing a policy on new services for specific routes. If the traffic of Supplemental Air Carriers on a route or group of routes exceeds 15% of the traffic of the certificated airlines in a period of one year, a case will be instituted to determine whether a supplemental carrier or a certificated carrier should be chosen to provide additional air service in the area.

Gurney, Denny Dissent

CAB Members Chan Gurney and Harmar Denny filed a sharp dissent from the majority decision to set up the 10 flight rule, calling it a return to the law of the jungle. The two members agree with findings on Supplemental Charter Service.

Gurney and Denny said the decision to authorize individual sale service "is economically unsound, makes a mockery of regulated competition, is an open invitation to law breaking, and marks a radical departure from established principles of national transportation policy.

"In sum, we feel that the majority action falls little short of an irresponsible abandonment of the Act which this Board is charged with administering."

In their dissent, Gurney and Denny said that the majority has taken the easy way out and perpetuated the problems the Large Irregular Case was supposed to solve. They expressed the fear that the decision will allow the irregulars to establish a scheduled route-type service, in effect granting them a certificate without making them meet the standards of the Civil Aeronautics Act.

Air Traffic Control Will Determine Any Reduction of Collision Hazard

By Alpheus W. Jessup

Indianapolis—Alleviation of the mid-air collision hazard, a major worry of the air transport industry and Air Force, reduces almost exclusively to functions of air traffic control. This was the general consensus of airline representatives, airline pilots, manufacturers and Civil Aeronautics Administration officials at the recent anti-collision symposium sponsored by CAA and the Illuminating Engineering Society.

Suggestions included improvements in aircraft lighting and more conspicuous painting.

Development of various airborne avionic devices to warn pilots of potential collisions was strongly recommended by pilots.

But every session eventually returned to the proposition that the collision hazard was imminent now and that it had to be met with available traffic control measures.

Near Misses Common

The magnitude of the danger was outlined by the Air Transport Association, Air Line Pilots Assn., and Air Force. Near miss data compiled during a one-year period from pilot reports to an ATA committee dramatized the problem. ATA will not release total number of near misses reported on its pilot questionnaire, but a reported average of four per day during a typical month was considered close.

Walter G. Jensen, an American Airlines pilot, speaking for ATA, said: "A sufficient number of near misses were reported to convince use that we have a problem that requires solution.

"With regard to the nearness of the miss—in this particular study, the 'miss' was much too close for comfort."

Of the near misses tabulated by ATA:

- 60% **were in major terminal areas** or near airports having control towers and 36% enroute.
- 65% **occurred** in broad daylight.
- 43% **happened** when visibility was 15 mi. or more.
- 87% **were within** controlled airways, areas or zones.

Air Force safety officers reported that their mid-air collision accidents have averaged about seven per month since 1952.

In the majority of the incidents, flight was straight and level and pilots failed to see the collision object.

J. D. Smith, a Capital Airlines' pilot representing ALPA, warned that pilots are being required to operate beyond the capabilities of human eyesight. He pointed out that aircraft now being operated have closure rates faster than the speed of a pistol bullet. As a consequence, there is a "growing movement within ALPA membership to operate all flights within the United States under IFR conditions at all times."

Voluntary raising of VFR minimums is being seriously considered also. ALPA charges that the agencies responsible for safety are not bringing realistic criteria into effect.

Jet Airliner Hazard

To today's problems, Lt. Col. Jack Tueller, chief of the Flying Safety Branch of the Strategic Air Command, added that of interjecting jet airliners into the high altitude air space. SAC operating alone above 25,000 ft. has a "serious collision" problem now, and it is taking steps to bring its own air-

craft under positive control at all times. SAC, obviously, wants preparations started immediately for the control of all high-altitude traffic when DC-8s and 707s go into service in about three years.

A few participants, including some from CAA, questioned what the statistics meant and how a near miss was defined. They agreed, however, that even heavy discounting of the ATA survey could not detract from the conclusion that the problem was serious.

Throughout the meeting, a genuine dilemma perplexed even those participants who painted the blackest picture of the collision hazard: The desire to jolt CAA, the Civil Aeronautics Board, the Government and the public so hard that programming and budgeting of adequate funds for corrective measures will begin without delay and the fear of scaring the public off the airlines.

Hanging over the meeting, too, was a regret at its lateness. M. G. "Dan" Beard, assistant vice president of American Airlines and symposium chairman, expressed the feeling of many, "I am embarrassed, being an oldtimer in the game and finding this situation coming up on us."

ALPA, ATA and Air Force recommended generally similar areas to consider in revising traffic control.

Robert Stone, an Eastern Air Lines pilot, representing ALPA, suggested:

• **Revision of VFR criteria.** Speeds of new aircraft have become so great that old concepts are outdated and varying visibility minimums may be necessary for different categories of aircraft. The range might run from one-half mile for helicopters to three miles for light aircraft to seven or eight miles for DC-7s to 10 mi. for jets. Horizontal and vertical separation from clouds must be increased.

• **Control zones** wherever instrument approaches are approved. At several airports it is perfectly legal for aircraft to operate beneath clouds through which airliners descend on instruments.

"A regulation(s) which permits some farmer to legally fly his plane just beneath the base of clouds as I make a letdown is an open invitation to a mid-air collision."

• **Speed limits** in high density traffic areas. "Right here at the Speedway they have traffic rules which make more sense than some of our rules. When the green light is on, the cars make speed just as airplanes do on the open airways, but when congestion develops, the yellow light comes on and the cars slow down and no passing is permitted. There's a time and place for speed and there's a time and place for control."

• **Positive control** of all traffic in the

TF-102A's First Flight

Convair's TF-102A side-by-side trainer (AW Oct. 17, p. 109) is shown above taking off from Edwards AFB on its maiden flight and, at right, as it returned after 30 min. in the air. Company officials said the trainer, which also can serve as a tactical weapon, "handles just like the F-102-A." Principle external difference between the fighter and trainer is the latter's broad, stubby nose section. The trainer's principle duty will be to familiarize pilots with the flying and fighting of a supersonic weapons system.

New York, Los Angeles, Washington and Chicago terminal areas.

Jensen, on behalf of ATA, supported Smith's recommendations for reconsideration of VFR regulations. He reiterated that the "see and be seen" principle was completely outmoded by the density and speed of today's air traffic, as frequently pointed out by ALPA.

This places the burden on air traffic control which, he said, "must be capable of control separation in good and bad weather with transmission of traffic information quickly along with clearances to deviate from flight course."

He asked for greater use of radar in traffic surveillance, direct communications between pilot and controller and better display of traffic information at control centers.

ATA has recommended a change in CAA policy, Jensen reported, calling for extension of traffic control protection to all types of aircraft in good and bad weather with limited exceptions. The exceptions would be private aircraft operating under regulation at low altitudes and certain military training flights. To reach this goal, the CAA must immediately program expansion of its capability, incorporating all known devices available and implementing research for new devices.

Visual Limits

Any doubts as to ATA and ALPA observations of the antiquity of the "see and be seen" principle were completely dispelled by Dr. Walter Grether and Lt. Col. George Emerson of the Wright Air Development Centers' Aero Medical Laboratory and Capt. Norman Barr of the Naval Medical Institute. They outlined the physiological limitations of visual observation which pilots have proven in flight.

Jensen and Stone both stated a requirement for proximity warning radar. "It must be possible to build radar which will put the airplane in a sphere of safety so that it can cruise along, and the pilot will be certain that he will receive an alarm whenever another airplane enters his sphere," Smith said. Since the pilot cannot watch the radar scope at all times, ATA and ALPA believe the device must monitor itself and sound an alarm so that the pilot will look at his scope for the information necessary to take evasive action.

SAC safety officers supported this request. They said that SAC bombers were using their K-bombing systems as a primitive device. Intruders into an aircraft's airspace create static on the radar scope, warning the crew to begin scanning for a possible collision object. This is particularly necessary since a B-47 crew must keep its attention centered in the cockpit 75% of the time flying the airplane.

Other specialists discounted the practicability or need of a warning device. George Johnson from WADC's All Weather Flying Branch, suggested that such a device would have to compute and tell the pilot exactly what evasive action to take and, therefore, would be too complicated. He outlined instead a concept of traffic control to "design collisions out of the air traffic control system" through immediate revision of air traffic rules and regulations and improvement in the use of existing equipment. It is perfectly feasible, he said, to establish complete ground control from a central location with positive surveillance of all traffic by radar and automatic position reporting, transmission and posting. A free air space up to a certain altitude would be made available for light aircraft under Johnson's scheme.

Industry Groups Urge Termination Of Renegotiation When Law Ends

By G. J. McAllister

Washington—Termination of the Renegotiation Act when the present law ends in 1956 was demanded last week by the National Security Industrial Assn. and the U.S. Chamber of Commerce.

NSIA said that renegotiation as a profit control "club" is a technique which does not foster the desirable mutual confidence of Government and industry in their business dealings.

The Chamber of Commerce said renegotiation has no place in a peacetime economy because it becomes a profit control device which drives low cost, efficient manufacturers away from defense production.

These reactions came following recent determinations by the Renegotiation Board calling for substantial refunds from two aircraft firms—Boeing Airplane Co. and Temco Aircraft Corp.—as excessive profits earned in 1952 (AW Nov. 7, p. 12; Nov. 14, p. 18).

These 1952 redeterminations have profoundly disturbed the aircraft industry. Profits earned in 1953 and 1954 have not yet been examined by the Board.

Lose Incentive

NSIA pointed out that renegotiation discourages the maintenance of a broad mobilization base. "This is so because renegotiation diminishes the financial incentive for the best producers to continuously improve their efficiency in fulfilling Government contracts when the potential rewards of turning these same talents to commercial production can be so much more rewarding," NSIA said.

The uncertainty of a company's financial status under renegotiation was emphasized by NSIA. The association said that no company can plot its future growth and development when there "hangs over its head a financial hazard which can require two, three or more years to be finalized. . . . The threat of an unpredictable renegotiation refund can completely upset any sound plan of internal financing."

NSIA pointed up a situation that is puzzling industry: Reversals in Regional Board recommendations by the statutory Board in Washington.

"No small group of men on a Renegotiation Board, regardless of their qualifications, experience and intelligence, can equitably pass judgments on what constitutes fair profits for performance of Government contracts," NSIA said. "It is inherent in a human being that regardless of the information presented or the factors considered the final decisions tend to be arbitrary. The tangible evidences of this, to industry, are the observable differences of opinion as to what constitutes excessive profits as it shows up among Regional Boards in dealing the same national industrial organization."

Recent reversals of Regional Board decisions include the Temco and Boeing cases.

Discrimination Claimed

The Renegotiation Board is aware of industry's concern over its action, but will not publicly release its facts and reasons for its redetermination actions. The Board claims its status as a quasi-judicial agency forbids such releases. Thomas Coggeshall, acting Board Chairman, said: ". . . We often find ourselves in the position of 'peacemakers.' Although the 7th Beautitude as set forth in the Gospel according to St. Matthew reads: 'Blessed are the peacemakers for they shall be called the children of God'—that has not been our experience to date."

The Chamber of Commerce cited two cases in support of its contention that renegotiation discriminates against efficient manufacturers.

First company makes a piece of equipment priced at $10,000 with a profit of 25% before taxes while the second firm sells the same equipment

to the Government for $12,000, but it realizes only a 10% profit on the transaction.

Under the present administration of the Renegotiation Act, the Chamber said the first company would be subjected to renegotiation but the second would not.

The Chamber said the second company, whose excessive price represents the cost of inefficiency, would pay the refund if "renegotiation were a pricing rather than a profit control measure."

There are many cases, the Chamber claimed, where top flight companies have paid renegotiation refunds while their inefficient competitors have been cleared.

Sagebrush Maneuver:

Atomic Attack Tests Dispersal Concept

By Claude Witze

Fort Polk, La.—When the first atomic blows were struck in Exercise Sagebrush last week, this huge military maneuver was opened with a realistic test of USAF's concept for the dispersal of tactical air forces.

Within a matter of minutes, Aggressor planes dropped simulated nuclear weapons on 18 U. S. and friendly air bases as far north as Langley AFB, Va. Opening the exercise with an all-out coordinated air-ground assault, it still was clear that the Aggressor's prime goal was to cripple retaliatory power of the U. S. air units.

The air attack was made by Martin B-57 light jet bombers that dropped the equivalent of 350,000 tons of TNT on the bases scattered over 10 states. It was not announced how many B-57s were used, but seven were intercepted and four "shot down" by North American F-86Ds flown by U. S. Force pilots. Presumably the entire attack was carried out by not more than 25 aircraft.

Only a few hours before the mock air assault, Maj. Gen. Edward L. Timberlake, Commander of Tactical Air Command's Ninth Air Force and air commander of all U. S. forces in Exercise Sagebrush, told AVIATION WEEK that during the entire maneuver TAC units will use more than 50 air bases in 12 states to try out the dispersed unit concept.

Dispersal Problem

Gen. Timberlake said the USAF realizes there can be such a thing as overdispersion, and he hopes Sagebrush will help make it clear just when TAC will reach the point of diminishing returns in employment of the protective concept.

He pointed out, for example, that one of his rear bases used for maintenance and as a home for heavy tools and equipment could provide more service than the three forward bases being used by North American F-100 Super Sabres and F-86H Sabrejets.

"We could break it into more satellites," Timberlake said, "but there always is the possibility that we may go too far. The goal is to maintain the maximum of control and yet conserve our forces as much as possible."

Tactical Air Forces set up for Exercise Sagebrush, both capable of delivering nuclear weapons, are Gen. Timberlake's 29th Air Force and the Aggressor's Sixth Air Army commanded by Maj. Gen. Edward H. Underhill. Both air forces were created from the Ninth Air Force and include units of TAC's 405th Fighter-Bomber Wing.

'Communicator's Nightmare'

Combat elements of the two maneuver air forces are widely dispersed on forward air bases with support units located far to the rear to provide maximum immunity to air attack.

Gen. Timberlake told AVIATION WEEK that the setup "creates a communicator's nightmare." He pointed out that at one rear-base communication lines were needed between that maintenance, or "mother," station and each of three satellites. In addition, a connection is necessary from the main base to his joint operations center and from there to each of the satellites.

An Aggressor attack such as the one that opened the air war naturally wrecks this arrangement. If Base A is put out of business even for a period of hours and some of its aircraft diverted to Bases B and C, the vulnerability is increased. If a fourth base is introduced to replace A, a new burden is added to the communications system.

TAC has been working on this problem for several years, Gen. Timberlake said, and the best existing solution is "wagon wheels," a mobile communications center built in trailers. It can be moved out of danger if there is ample warning. There are duplicate outfits, one at Gen. Timberlake's forward headquarters and a reserve in the rear.

"This is a big improvement over what we had in World War II," Gen. Timberlake said, "but we're still thinking of mobility in terms of wheels. What we need is something in an aircraft, much smaller, more powerful, probably less elaborate."

Airborne Command Post

He has a TAC model illustrating the point. It is a Douglas C-124 with miniaturized equipment. It can be moved at short notice, always stay with the command. This airborne command post, Gen. Timberlake pointed out, would not completely replace his "wagon wheels" project, but would be an invaluable auxiliary in case of emergency.

On the eve of the first air action in Sagebrush, and before Aggressor Forces had smashed a substantial number of his bases, Gen. Timberlake said he believed conventional-type weapons will be retained in the foreseeable future, at least for certain types of air strikes.

An example is his knowledge that in Exercise Sagebrush advances by Aggressor ground forces will be channelized to a great degree. There are about four general wide paths through which they can push with armor. For TAC's defensive operations, this could call for a high rate of sorties with ordinary bombs of the type used in the Korean war.

"On the other hand," Gen. Timberlake said, "we know very well that the fighter-bomber with nuclear weapons can bring about big destruction. Perhaps we should not concentrate heavily on the multiple-sortie type of operation but make sure that a few planes get to the target. That is why our organization needs to be built to insure the success of the nuclear mission."

Service Cooperation

At the Joint Operations Center there was every evidence at the start of Sagebrush that Air Force and Army officers

Special Reports

Aviation Week is bringing is readers a series of special reports on how new missiles, helicopters, aircraft and atomic weapons are operating under combat-type conditions in the first large scale USAF-Army maneuvers employing new concepts of tactical airpower.

This is the second report from Operation Sagebrush by Aviation Week's military editor Claude O. Witze who is writing from air bases, missile launching sites, and assault helicopter units on how these types of new equipment are performing under field conditions within the framework of the controversial new atomic tactics developed by the U. S. Air Force and Army.

Army Bars Troops from USAF Copters

Ft. Polk, La.—Some U. S. Army personnel have been forbidden to ride in U. S. Air Force helicopters, it was learned here during the early phases of Exercise Sagebrush, joint USAF-Army maneuver. The order, Aviation Week was told by reliable sources, was issued at a high level in the Army command, although all efforts to find out who issued it and the reason for the order were unsuccessful.

USAF Gen. Otto P. Weyland, maneuver director, told Aviation Week he did not feel he should answer the question because of his present position as head of a joint command.

First confirmation of the Army order came early in the maneuvers when a group of Army troops refused to board a USAF H-21 helicopter for transport from England AFB to Ft. Pope. The Army troops said they could not ride in a USAF rotary winged aircraft but accepted a flight in a fixed wing C-119 transport.

Practical effect of the order, if it sticks, will be felt when airborne troops are called upon to make their first drop in Exercise Sagebrush. Initial operation in the drop zone will be the landing of a USAF combat control team by Piasecki H-21 Work Horse helicopters flown by pilots of the 516th Troop Carrier Group of the 18th Air Force. This team will direct pilots over the zone when paratroops are brought in by C-119 units.

After the combat control team is landed, next step is for the helicopters to return with the U. S. Army's famous Pathfinders, a special group of combat experts who are landed to protect the USAF team from enemy fire.

Under the Army order, the Pathfinders will be eliminated and the Army must find another way to get them into the drop zone in the face of enemy opposition.

were prepared to work in complete co-operation. In a long temporary shelter, a simulated underground JOC, a large sign declares:

"This JOC is the Air Force facility where the daily Tactical Air Force operations are planned and controlled. Here the Tactical Air Force staff and field army staff accomplish co-ordination necessary to insure full integration of all phases of air-ground operations."

Progress of the entire exercise, from the viewpoint of the U. S. defending forces, can be watched in this shelter. Adjoining it is the Tactical Air Control Center, where all aircraft in the maneuver area are plotted, for either attack or interception.

Final evaluation of Gen. Timberlake's JOC and the one being used by Gen. Underhill may not come until weeks after Sagebrush is finished. The results will have an important bearing on future TAC doctrines and fields of activity for the Army's fast-growing interest in operation aircraft.

Admiral Cites Need For Good V-2 Defense

San Francisco—The commander of the Western Sea Frontier said last week that there is no good defense against V-2-type missiles and that no one has come up with a good estimate of our probable percentage of effectiveness against jet bomber attack.

Speaking before a meeting of the National Security Industrial Assn., Vice Adm. F. S. Low made a strong plea for greater seapower and said the best defense against nuclear warfare contrived thus far is an overwhelming offense against enemy bases.

"The one secure defense, unless one can be sure of striking first—which is not part of our national philosophy—lies in convincing any potential enemy that, should he strike the first blow, he will be the recipient of overwhelming and fatal attack," Adm. Low said. He added:

"With our present knowledge, we know that against missiles of the V-2 type there is practically no satisfactory defense.

"Against any such missiles the only solution, and against today's weapons a more effective solution, is to destroy the bases from which they might be launched."

Our own bases, as we advance them toward potential enemy targets to increase the range of our present bombers and missiles, Low said, offer exposed targets to surprise attack. He suggested that sea bases be decentralized and scattered so that their exact location cannot be predicted by the enemy. These moving bases (against which Low said long-range pilotless missiles would be ineffective) would include carriers capable of launching aircraft and guided missiles and submarines capable of launching guided missiles.

Low said increased use of seaplanes supplied by submarines might also be expected in areas where maintenance of other forces would be too costly or where topography would prevent operation of heavy task forces.

He added:

"As of today the carrier, far from tending toward obsolescence, has not yet reached its ultimate development as a major weapons system. Further, the principle of the mobile air base, which it exemplifies, is logically experiencing a resurrection among air power thinkers everywhere."

He said we are in the midst of evolving from the World War II task force, which would have been a sitting duck for atomic attack, to the task force of the future. He visualizes a typical carrier striking force of the next five or ten years as consisting of three or four large carriers, a half dozen or more heavy supporting ships and fast logistic support ships protected from submarines by helicopters. Major warships would be nuclear propelled and able to operate for longer periods without replenishment.

Whereas the typical carrier task force of World War II occupied about 50 sq. mi., the new force might cover about 30,000 sq. mi. Low said:

"The offensive punch of such a force would include aircraft to deliver large weapons under all weather conditions to great distances, and smaller supersonic aircraft able to deliver atomic missiles at medium ranges. Nuclear powered submarines would be available to operate on the fringes of the task force."

Such a group of ships, the Admiral predicted, with a defensive system based on guided missiles, instead of short range antiaircraft weapons, would exert tight and exclusive control over an area the size of the State of Washington.

Hughes to Put Products On Commercial Market

Howard Hughes last week announced that products of his Hughes Aircraft Co. which have commercial application will be introduced into the general market through a newly established division to be known as Hughes Products Division (AW Oct. 24, p. 9).

Until now, developments of the company's research have been utilized only in the Falcon guided missile and avionic systems for interceptor airplanes.

The new division will be located at Hughes Aircraft Co. headquarters in Culver City, Calif. R. M. Russell, former general manager of the Gas Turbine Division of Continental Aviation and Engineering Corp. of Detroit, will manage the division.

"For the present," Hughes said, "the new division will concentrate on the field of semiconductors (germanium diodes, silicon diodes and transistors), electronic storage display tubes and related products, all outgrowths of specialized developments in the areas of electronic systems, computers and guided missiles."

USAF Testing Missiles, Engines At Uncompleted Tullahoma Center

By David A. Anderton

Tullahoma, Tenn.—Significant progress in missile and engine testing has been made during the last two years at the Air Force's Arnold Engineering Development Center here. It includes:

• **Missile models** of the Hughes Falcon air-to-air weapon, the Army's surface-to-surface Redstone and the nose cone of the Atlas intercontinental ballistic missile have been tested in tunnel E-1 of the Gas Dynamics Facility.

• **Eight turbojet engines**—including two different types of General Electric's J79 scheduled for the supersonic Lockheed F-104 and Convair B-58—have been run through exacting programs in the cells of the Engine Test Facility.

Other developmental testing has been completed on models of the duct inlet systems for Republic's F-103 and F-105 fighters. A Marquardt supersonic ramjet engine is currently operating in one of the ETF cells.

Major facility additions in the last two years include completed test cells of the Engine Test Facility. These began running in May of 1954.

No new tunnels have been added to the Gas Dynamics Facility since E-1 began its calibration runs more than two years ago.

The transonic circuit of the gigantic Propulsion Wind Tunnel is nearing completion, and AEDC personnel expect to start testing late next year. The supersonic circuit is under construction.

F. H. Richardson, former AEDC Chief of Staff and now its Technical Director, said that construction was about 70% complete. New facilities will be added at the rate of approximately one every six months for the next three years. When completed to present plans, Richardson said, AEDC will represent about $300 million in construction and equipment cost.

Other expected starts next year include the 40-in. by 40-in. supersonic Tunnel A of the Gas Dynamics Facility, with an anticipated Mach number range from 1.2 to 5.5; Tunnel B-Minor, a 50-in. diameter supersonic tunnel designed as a predecessor to Tunnel B, and Tunnel E-2, a duplicate of the 12-in by 12-in. supersonic E-1, but with a range from Mach 4.5 to an estimated Mach 10.

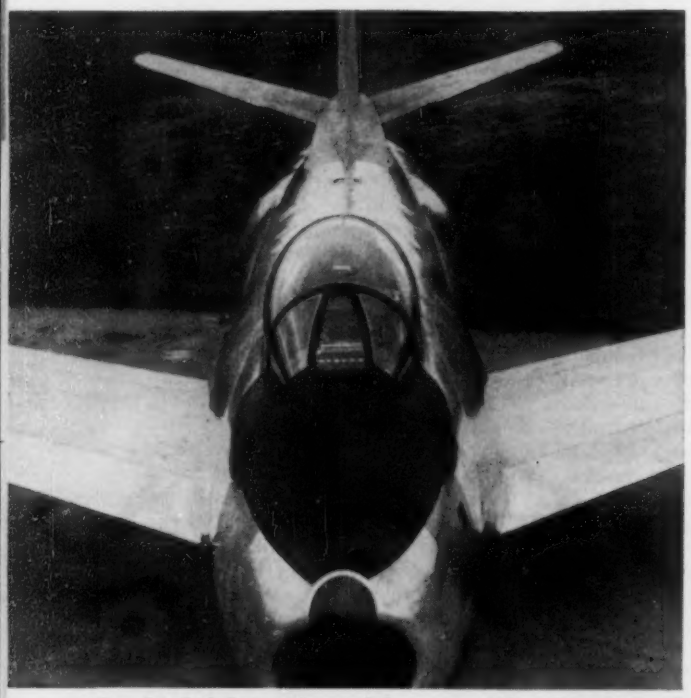
A unique supersonic nozzle developed for the ramjet cell of the Engine Test Facility makes possible an accurate simulation of a complete flight program for a ramjet engine powerplant.

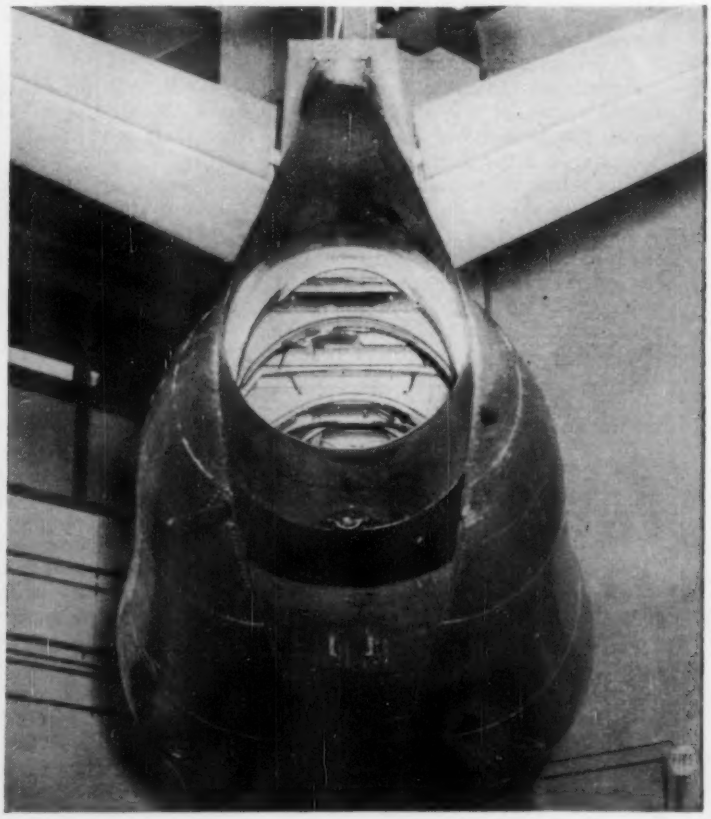
The nozzle is adjustable to produce variations in the Mach number and angle of attack, so that the entire flight range of a trajectory can be covered. Two flat side walls and two adjustable contour walls, with supporting equipment, make up the nozzle section.

It weighs about 30,000 lb., comparable to a piece of heavy artillery, yet its control and motion are extremely precise. Motion around one set of pivots changes the Mach number by changing the contour of the supersonic nozzle formed by the flexible walls. Motion around another pivot changes the angle of attacks of the flow directed against the ramjet engine.

Data produced in the Engine Test Facility and the other operating units of AEDC are fed into one of three ERA-1102 Univac Scientific Systems, made by Engineering Research Associates Division of Sperry-Rand Corp.

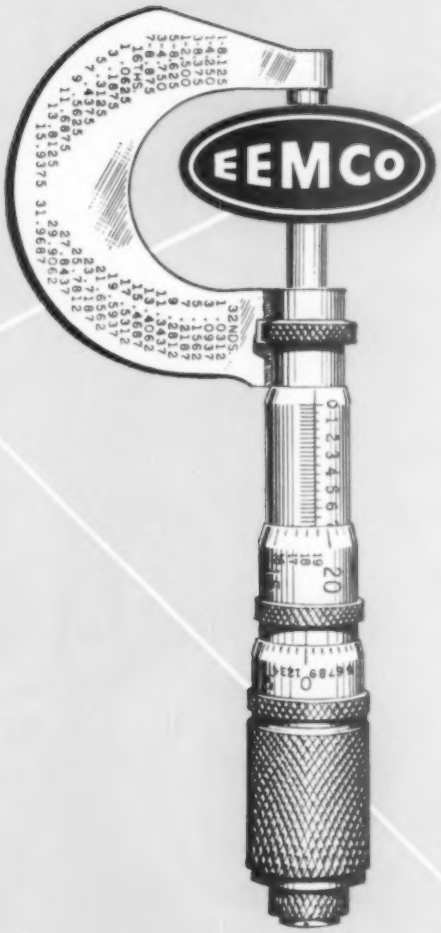
'Wasp Waist' for the Sabre





Canadair Ltd. last week revealed an area-ruled, and experimental, F-86 Sabre. Applying the NACA principle to reduce drag rise, Canadair bulged the Sabre at top of the fuselage forward of the canopy; along the side through part of the wing root and along the aft half of the fuselage. Result: a "wasp waist."

Since 1942



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FIRST PRIVATE PURCHASE OF ANY GCA EQUIPMENT

Gilfillan GCA Quadradar will bring complete radar traffic control to serve Northwest Orient Airlines and military traffic at the crossways of the Great Circle Route.

Two Gilfillan GCA Quadradars have been purchased by the Navy to function with Operation Deep Freeze at the South Pole. Gilfillan GCA Quadradars are now in operation in both polar regions. Eight have been purchased by the Royal Canadian Air Force for remote Arctic bases; two by the Finnish Air Force for similar operation.

OTHER QUADRADAR PURCHASERS:
United States Army; United States Marine Corps; United States Air Force; French Air Force; South African Air Force; Irish CAA; Austrian CAA.

In addition, Quadradars will shortly be in operation in Australia, New Zealand, Sweden, Denmark, Belgium and Holland. Never before has a navigation aid received such immediate universal acceptance as the proven Gilfillan GCA Quadradar.

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Boeing's Tex Johnston Describes . . .

Flight Characteristics of the 707 Airliner

By A. M. "Tex" Johnston
(*Chief of Flight Test, Boeing Airplane Co.*)

An airplane is just a lot of expert opinions until it actually proves itself in the air. What I'm going to write here is not opinions on what an airplane of the future should be able to do, but what an airplane of the future has already done.

I would like to make a few comments on certain handling characteristics of the Boeing 707 prototype that I think would be interesting to people in aviation.

These are based on the experience gained in more than 300 hours of testing the prototype.

We at Boeing have had considerable experience with sweptwing airplanes. We have encountered no unusual problems with them. The first two were the B-47 and the B-52. Compared with them, the 707 prototype is as good in all respects, and better in some.

Takeoff characteristics of the 707 are the same as for any tricycle geared airplane.

The climbout and cruise are entirely normal except for a marked improvement, from the pilot's point of view. His duties are considerably reduced due to the simplicity of the powerplants and the cockpit simplicity which results.

Elimination of superchargers, propeller controls, mixture controls and so forth makes it a lot easier as far as manipulating the airplane is concerned.

The 707 is very maneuverable. Control forces are light. Unlike the B-47, this airplane does not utilize power control, which means we don't need a backup system and the weight penalty which would be associated with it. With the exception of the spoilers, the airplane's controls are manually operated for lateral, directional and longitudinal control.

Lateral Control

There is enough lateral control with the manual system to fly the airplane in the event of loss of hydraulic pressure in the spoiler system.

A word about the lateral control system specifically—we have gone to this

Johnston in Jets

Tex Johnston began flying multi-engine, heavy jet aircraft in 1949 when he joined Boeing as project pilot for the B-47.

He piloted the YB-52 on its first flight in early 1952 and on many subsequent test flights.

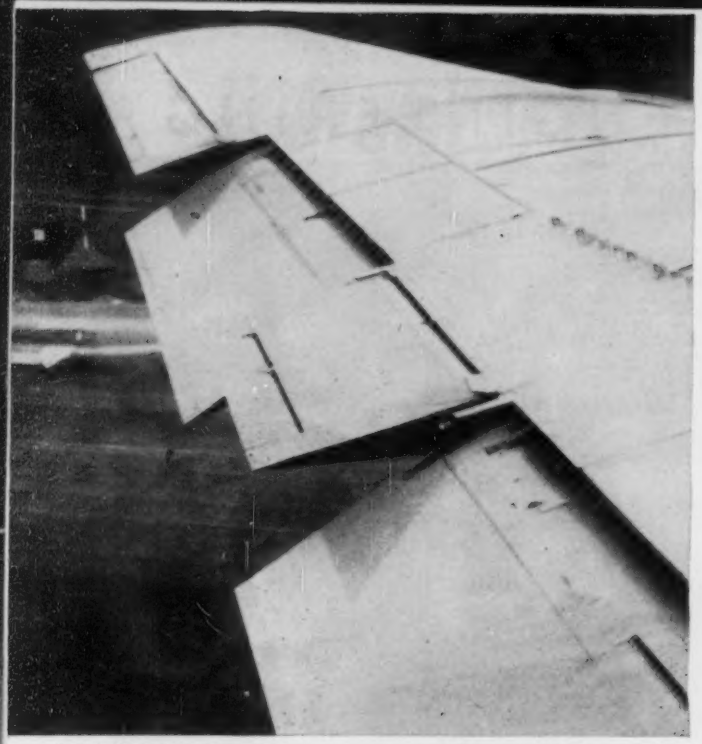
He flew the 707 on its initial flight and for a large part of its test program.

His experimental test flying started in 1952 with Bell Aircraft Corp.

While with the company he piloted the first flights of Bell's RP-63 King Cobra, TP-39 Airacobra, P-63 and L-39.

He also was one of the first pilots to fly the Bell X-1, first supersonic airplane.

Johnston started with a barnstorming flying circus in the early 1930s. Later, before going with Bell, he served as flight instructor for the Army Air Corps and as a ferry pilot in the Air Transport Command.



TAKEOFF—Spoilers are down, flaps are coming up. Spoilers and both aileron segments are operable when flaps are down.

CRUISE—Spoilers are down, flaps up. From bottom to top: inboard flap, midwing aileron, outboard flap, outboard aileron.

particular configuration to retain sufficient lateral control effectiveness at high speed. We also needed a drag device for approaches and letdowns, and we got that "for free" in adopting this lateral control system. The drag device is the spoiler system.

When the spoilers on both wings are raised symmetrically, they increase drag and improve the handling characteristics at low speeds.

On the B-47, approaches were comparatively flat due to the acrodynamic cleanness of the airplane and the considerable thrust at idle rpm. Using the lateral control spoiler on the 707 to produce drag, a wide variety of approach angles can be followed. The approach also can be adjusted through use of spoilers as air brakes: If the approach path is too high, the application of additional spoiler will bring it down to the correct approach path, after which the additional spoiler can be taken off.

Speed can also be decreased through use of the spoilers as air brakes.

Control forces felt by the pilot are very light, even at the higher speeds. With one hand it is possible to actuate full control without muscular exertion.

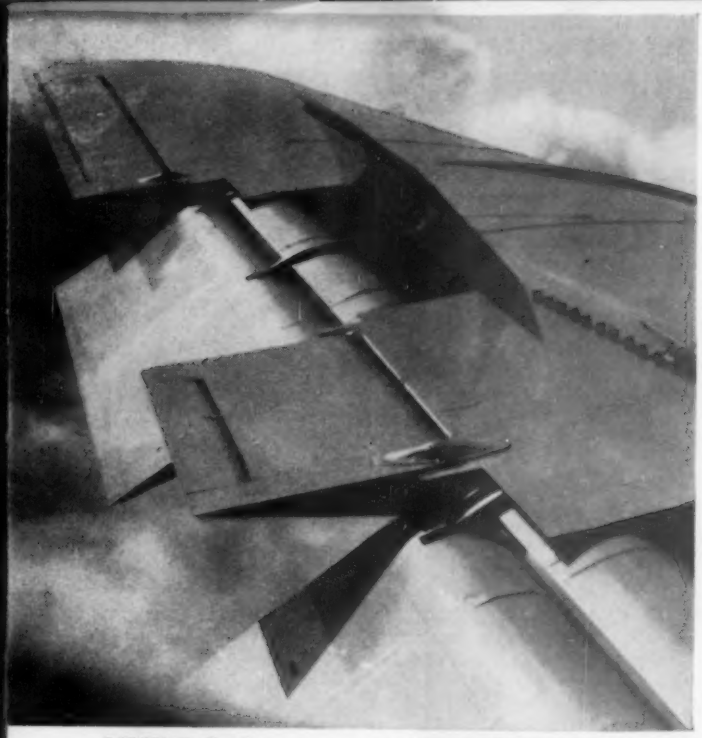
'Most Honest Stall'

Now a word or two about low-speed characteristics when going into a stall.

This airplane has the most honest stall of any airplane I have flown. It has adequate stall warning, both clean and with gear and flaps down. In both states, the stall warning range begins 10 to 12 knots above stall. It presents itself first as a tremor in the airplane. As the airplane decelerates, buffeting increases. A vertical bounce of the aircraft is felt with the airplane clean, and, with flaps down, the bounce is even more pronounced.

Both clean and with flaps down, the airplane can be stalled power on or power off with stick full back. The most critical condition is with power on since the airplane must be brought into a comparatively more nose-high attitude. If the airplane is allowed to roll slightly while in the stall adequate lateral control exists to correct this condition. Also, the directional control remains positive.

The great speed of the Boeing 707 has shown us certain things. There was a need to decelerate the airplane at high



DESCENT—Spoilers are up and flaps partially down. The 707 can safely descend at rates up to 14,000 feet per minute.

APPROACH—Flaps down, spoilers partially up for added drag. The 707 shows excellent lateral control characteristics.

speed in case of emergency, so the landing gear was designed to be lowered at high indicated air speeds and Mach numbers. It is obvious that, if you extend parts and pieces into the wind stream at these speeds, there will be a certain amount of buffeting.

I don't consider this any more than a phenomenon about which the cash customers will have to be informed in advance. It isn't severe at all, but when the gear is extended at very high speed and high Mach numbers, at altitude, there is more rumbling in the airplane than on slower speed machines.

High-Speed Flutter Tests

Just recently we completed a high-speed flutter investigation. During this program we flew the airplane at very high speeds and established a Mach number and an airspeed placard on the airplane. These limit speeds were not posted due to any stability or buffeting problem, but because I felt that we had exceeded the level flight capabilities of the airplane to the extent that these speeds would never be approached by any operator.

We had no difficulty carrying out this investigation. We started the test at very high altitude, around 45,000 ft., with full power. We first flew at maximum level-flight speed and then dived at a 15-deg. angle, terminating the test at 35,000 ft.

All high-speed airplanes when approaching their high Mach number limit show some change of trim. This airplane is no different. It does have a slight longitudinal trim change at the maximum speed we have reached. This is not instantaneous, but is a gradual build-up in force. It is easily trimmed out, and you can hold it manually if you want to work hard.

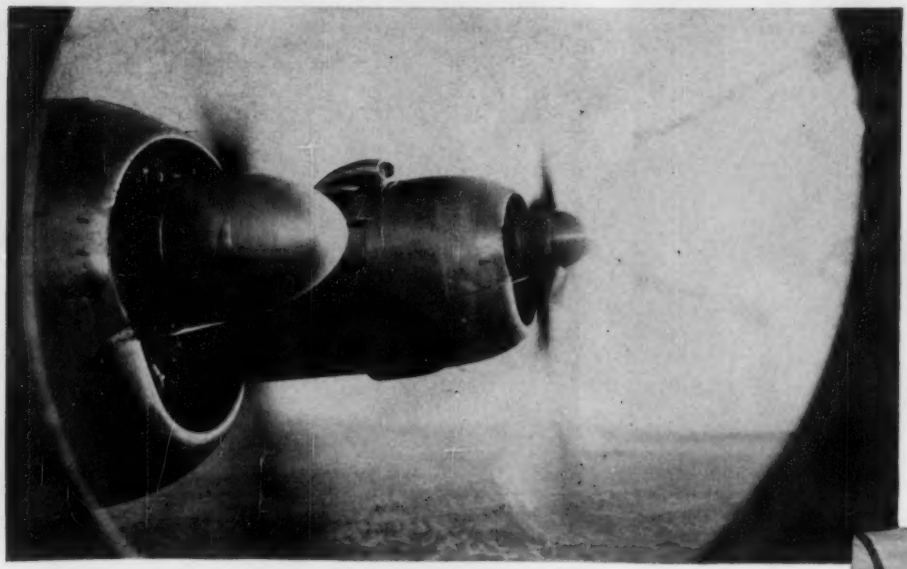
I don't think of this trim change as a problem. In fact, it is being decreased right now through a slight modification.

At the maximum speed, the airplane can be flown hands-off. I have maneuvered the airplane at top speed with the high-speed ailerons and spoilers working, and there is more than sufficient rate of roll.

I have conducted some of these dives with the spoilers inoperative and have made turns using full lateral control deflection at maximum Mach numbers.

If the pilot should for some reason

FLY WEATHER-WISE



These weather items prepared in consultation with the United States Weather Bureau

Rain drops from heavy cumulus clouds which fall from colder altitudes may cool cylinder heads enough to cause engine to misfire. Avoid heavier showers wherever possible.

Unlike showers, rain falling from stratified cloud layers may be warmer than the air through which it falls. Be prepared for poor visibilities in the cold air near the ground, as fog is likely.

To avoid turbulence along squall lines, plan your trip through the northern quarter of an active low. Although instrument conditions and ice in the winter may be encountered, the severest weather will be avoided.

Even though stations report good weather—conditions in between are occasionally poorer. You may be unable to maintain visual contact. Check all available information on en route weather as well as your terminal weather.

Best Pair to Get You There

STEERING CLEAR of stormy weather can add miles to your flight. Weather-wise pilots safeguard themselves with an extra margin of safety...keep tanks filled with Mobilgas Aircraft... protect engine performance with Mobiloil Aero. These famous products are the result of 89 years of research and experience—favorite with aviators since the Wright Brother's first flight. Why accept less for your plane?

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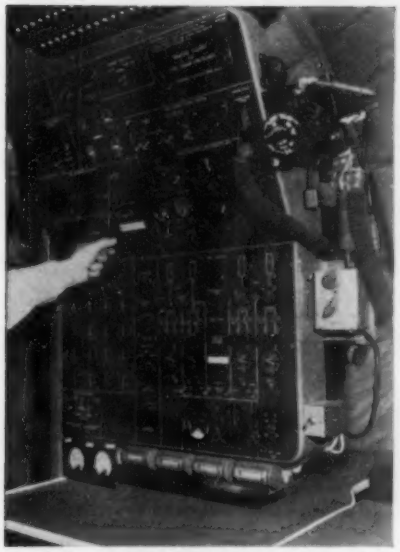


FLIGHT ENGINEER'S PANEL in the 707 is hinged and can be swiveled so either co-pilot or engineer may handle it. Position of gage needles at left is parallel when performance is normal, making it possible to spot a malfunction quickly.

have his attention diverted and the airplane were to leave level flight and get into a 15-deg. dive, there would be several indications that would warn him before the speed reached the placard limits.

First of all, there is the attitude—by the time an airplane is 15 deg. nose down, the attitude is such that the pilots will hardly overlook it. The airplane cockpit is normally quite free of noise and vibration, but, as speed and Mach number increase, there is an audible increase in noise that is a good warning.

Also just prior to reaching maximum speed, there is a slight lateral control "nibble" which shakes the wheel very slightly, maybe ⅛th of an inch, at a comparatively low frequency, probably four or five cycles per second.

At maximum speed, there is a very slight buffet in the airplane which is brought about by the initial separation of the airflow over the wing.

To sum up the capabilities of the 707 at high speed: This airplane is solid and safe—we have no flutter problems and no stability problems.

Descents at 13,000 Fpm.

High-speed letdown characteristics are very good. Using lateral control spoilers for dive brakes, we can make descents up to 12,000 or 13,000 feet per minute from altitude to the deck.

Landing speeds are very good. The airplane was designed to operate out of existing fields and we have proved that it can do so.

The landing attitude is normal for tricycle gear airplanes. Approach attitude is nose high, so the airplane does not have to be rotated much on the flare-out. As soon as you touch down, you can rotate the airplane over onto the nose wheel thereby spilling the wings, reducing the lift and putting weight on the wheels.

With the spoilers fully extended, which increases drag while destroying lift, more load is placed on the wheels and allows very hard and effective braking immediately after touchdown.

Thrust-Reverse Tests

In addition there will be thrust-reversing. We have already tested the initial configuration. We wanted to find out if we could reverse the hot gases forward without over-heating our nacelle or wing structure. Also, we wanted to be sure the reversed thrust would not blow debris forward where it could be taken in the air intake.

On the taxi test, I accelerated the airplane up to 85 knots and reversed at 100% power. We didn't go faster because of the unsymmetrical power condition: we had a thrust reverser on one engine only, Number two.

The thrust-reverser tests proved satisfactory.

These are some of the things we have learned in one year of flying the Boeing 707 prototype. They are things we could have had many expert opinions on, but things we couldn't have been certain of without flying the airplane.

Solid State Physics May Spark Revolution

Los Angeles—Within the next decade, a revolution in materials will result from research in solid state physics, Dr. C. G. Suits, General Electric Co.'s vice-president and director of research, predicts.

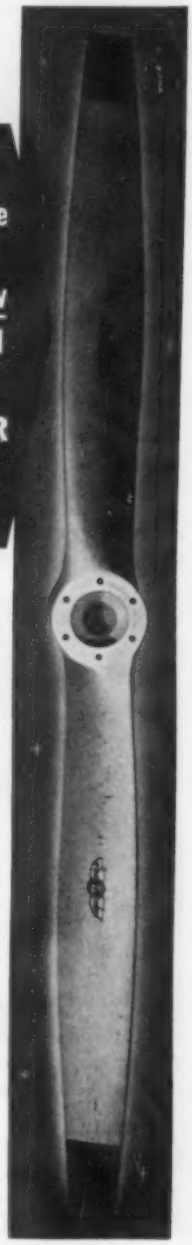
Pointing out that this research has been accelerated within the past five years, he said that it would lead to a host of new substances with physical properties excelling in high temperature strength, room temperature strength, corrosion resistance and magnetic performance. Benefits of the research already include development of semi-conductor devices such as transistors and diodes.

An important clue to the future in structural metals are the "perfect crystals" developed recently by GE metallurgists, Suits said. In this perfect crystal form, weak metals like zinc are stronger than our strongest alloys, he added.

New knowledge about detailed atomic structure of solids is giving a strong foundation for great advances in ceramics and plastics as well as in metals, Suits declared.

25 years of experience in aviation built the new SENSENICH METAL PROPELLER

CAA approved up to 165 HP



TWENTY-FIVE YEARS of design and manufacturing experience in building 400,000 propellers for light aircraft—that's the solid base on which the new Sensenich metal propeller was developed. Its unusual airfoil section, its thorough vibration survey and flight testing results in a metal propeller of maximum efficiency and dependability.

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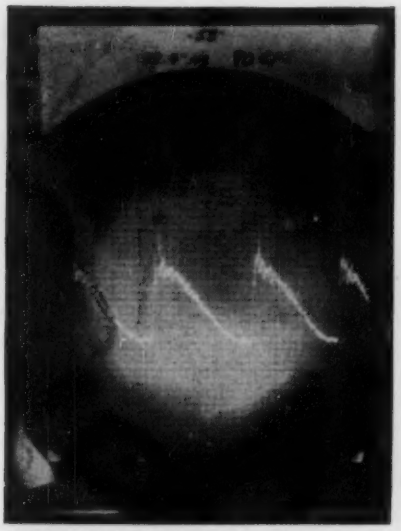
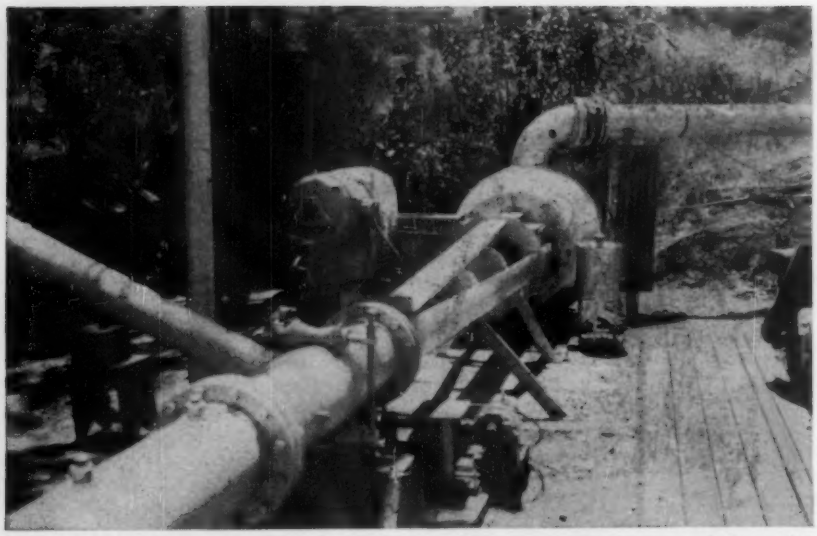
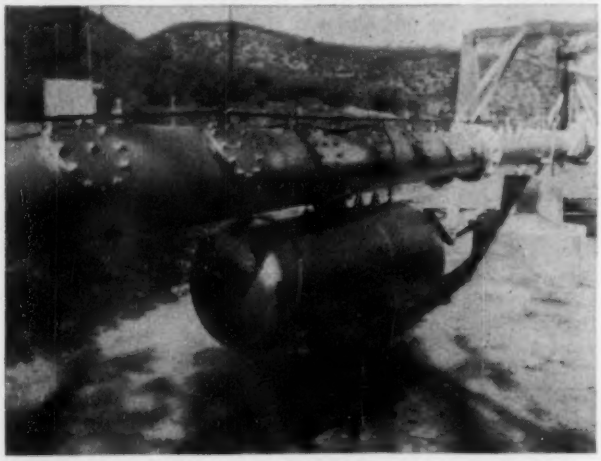


OSCILLOSCOPE records sound-wave pattern set up in sound tunnel.



SOUNDRIVE ENGINE CO.'S sound generator. Hollow arms conduct sound from disk valve source in plenum chamber (sphere in background) to sound tunnel (foreground).

TRAVELING MICROPHONE car held by Soundrive employee above picks up sound by running along track inside the tunnel.



UNDERSLUNG TANK at Soundrive facility shelters standard microphone which monitors traveling mike in sound tunnel.

Control of High-Energy Sound Seen As Path to Engine Improvement

By Irving Stone

Burbank, Calif.—Current research on the control of high-energy sound in aircraft jet, rocket and piston power plants may pay off in big performance and design dividends.

Already it has eliminated a combustion instability which was causing instantaneous destruction of a missile rocket motor.

Pioneering in this complex new field is Soundrive Engine Co., whose president, A. G. Bodine, holds more than 100 issued or pending patents having to do with high-energy acoustics. He heads a relatively small staff of about 30 scientists, engineers, acoustics specialists and shop personnel.

According to Bodine, some of the limitations to engine refinement are of an acoustic nature, with internal sound effects entering more and more into the performance picture. And as engine power levels are pushed up, the higher combustion chamber pressures aggravate the already-perplexing combustion acoustic problem.

Sound has been assumed by many to be an effect of detonation or combustion instability. However, the preponderance of research at Soundrive indicates rather that it is a cause.

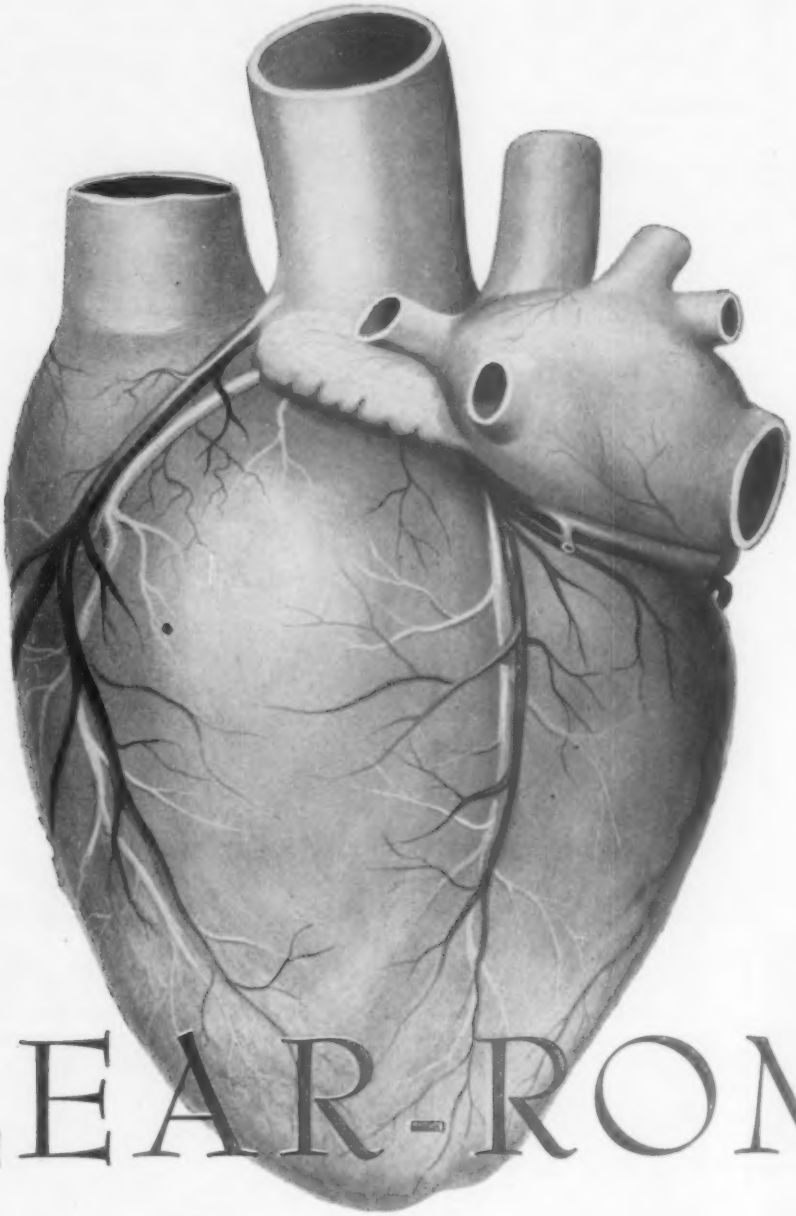
The sound waves, generated at low amplitude by various incidental disturbances in the combustion process, echo from the combustion chamber walls into the combustion area. This causes the combustion area to be periodic in burning rate, so the combustion, in turn, becomes the source of the sound. This regenerative process—it is self-sustaining and cumulative to high-energy sound levels—may wreck the engine, or seriously affect personnel in the immediate vicinity.

Ultra-High-Energy Sound

Soundrive's basic research and development is concerned with ultra-high-energy sound at any frequency. (This differs from ultrasonics, which merely is high-frequency sound.)

Little is known today about high-energy sound, Bodine says, but he believes resolution of high-energy sound problems associated with combustors should bring lighter, more efficient engines.

Engines could be lighter, Bodine says, because it would be possible to minimize structure now required to withstand the stresses imposed by gas



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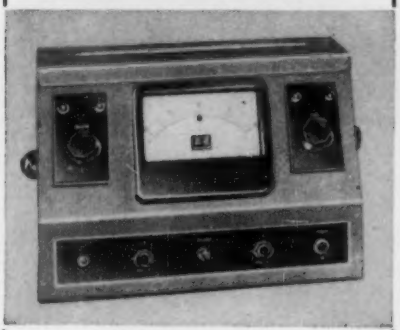
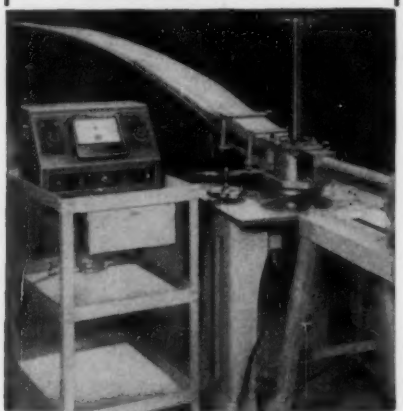
D&B RESEARCH

BALANCING MACHINE



MEANS:

- LESS BALANCING TIME
- ACCURATELY BALANCED PARTS
- GREATER SENSITIVITY
- LOW OPERATING COST



Kaman Aircraft Corp Now Balances Their Helicopter Rotor Blades And Assemblies On a Dean And Benson Machine

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pressure vibrations set up by high-energy sound.

More efficient engines would result through use of higher allowable operating temperatures. Problems of high temperature now are compounded by the coexistence of unwanted gas vibrations. Elimination of these vibrations would allow higher temperatures with existing design and materials.

In the case of the missile rocket motor mentioned above, the destructive combustion instability was believed to be an acoustic detonation effect, and Soundrive was given the problem for solution.

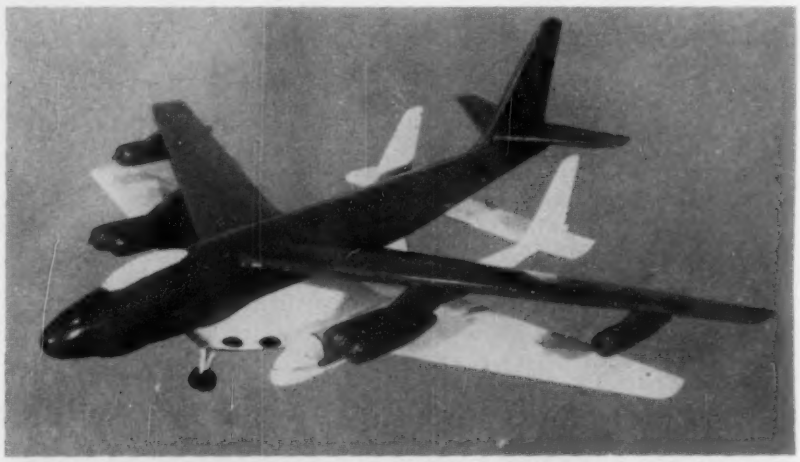
The trouble was eliminated by installation of Soundrive-developed detonation suppressors. The program lasted about a year and involved study with a number of different-size motors. In bench work at Soundrive, the combustion chambers were excited electro-acoustically to duplicate vibration conditions. The actual firings with suppressors were conducted at the airframe manufacturer's field laboratory.

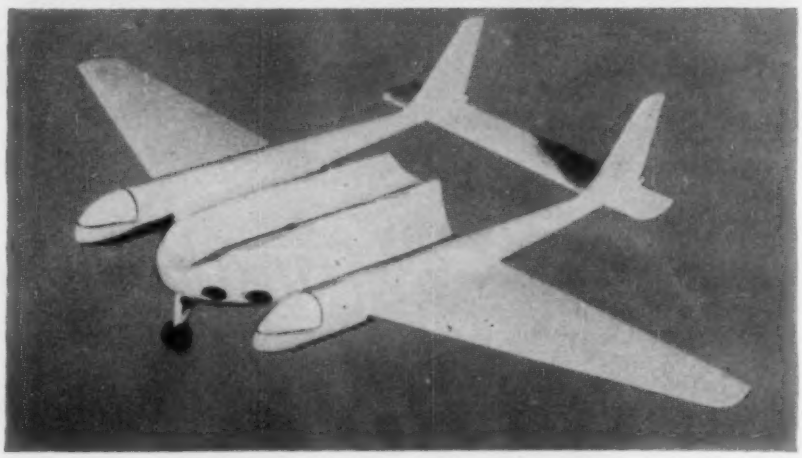
Developing the Mathematics

A large part of Soundrive's effort is concerned with fundamental studies in high-energy sound, sponsored by the Air Force National Advisory Committee for Aeronautics, the Navy Bureau of Aeronautics and Office of Naval Research. Purpose is to develop the mathematics required for analyzing high-energy sound of the type emanating from combustion sections of piston engines, turbojets, ramjets, rockets and afterburners.

The standard acoustics text books have never attempted to present the necessary mathematics, according to Bodine, because the old authorities have not had the necessary experimental data for developing the mathematics.

The Soundrive program already has





Piggy-Back Ride for Bombers

Goodyear Aircraft Corp. engineers believe they can increase the range of the B-47 Stratojet (and other aircraft) through the simple expedient of removing the bomber's weighty landing gear. The resultant problem, the engineers conclude, could be solved through the use of an auxiliary "piggy-back" aircraft (above) that would hook on for landings and takeoff. The bomber also would gain shorter takeoff and landing runs by combining its power and lift with that of the "piggy-back" plane. No mention was made of provisions for emergency landings when no "piggy-backs" are available.

The Defense Department's terse label for this new radar is "FPS-14"—but actually the vital role it plays is as a "line backer" or "gap filler," rounding out and tying together the complete aircraft warning system.

Thus the FPS-14 supplements and backs up other elements of the radar network on our defense perimeter—feeds its information to central plotting centers just as do the other radars in the network.

Because of the high degree of efficiency demonstrated by the FPS-14 — authorities are also predicting a bright future for it as a navigation-traffic-control system for commercial aviation.

The structures are built by Goodyear Aircraft Corporation for Bendix Radio Division of Bendix Aviation, pioneer of the FPS-14 and other electronic devices vital to this nation's defense.

In fulfilling the assignment, Goodyear Aircraft Corporation was able to utilize its design and metal-working skills in producing a 17½′ x 11½′ reflector to exacting contours. Goodyear Aircraft performs similar tasks for other radar structures.

It is another demonstration of the skill and craftsmanship exhibited by Goodyear Aircraft in serving the needs of an air-ready, ever-alert America. Goodyear Aircraft Corporation, Akron 15, Ohio. Plants in Akron and in Litchfield Park, Arizona.

GOODYEAR AIRCRAFT

☆ THE TEAM TO TEAM WITH in AERONAUTICS ☆

extended over five years, but because of the complexity of the non-linear mathematics involved, may only be about three-quarters finished now according to Bodine. Presentation of results will be theoretical but will be based on extensive experimentation.

Sound Tunnel

Here's how Soundrive derives its experimental data on this project:

A specially developed facility located in Pico Canyon, about 30 miles from Los Angeles, embodies what is probably the world's most powerful controlled-sound source. Sound waves are delivered from a 1,000-hp.-input siren-type generator at one end of a long sound tunnel.

A special high-energy microphone travels on a track inside the tunnel, and the signal from the mike is recorded by electronic equipment. In this manner, the life cycle of the sound wave can be studied by observing change in wave shape as it goes through the transition from source to dissipation.

Many types of wave suppressors are being coupled to the tunnel to note the effect on wave shape. This suppressor effect indirectly reveals the "stubbornness" of the sound wave.

Bodine feels it may take two more years of this type of experimentation to produce enough data for a comprehensive treatise on effects of high-energy sound in combustion chambers to guide the engine designer in developing ultimate forms of sound suppression.

Other direct benefits may include devices for reduction of sound nuisance emanating from facilities such as engine test stands, wind tunnels, airports. Bodine says this is one of the main reasons for military interest in the high-energy sound study.

Included in the overall study is the effect of high-energy sound on man and animals. This phase of the research, tied up with Air Force aeromedical studies, is still continuing at the Pico Canyon site, Bodine says.

Jet Engine Improvement

A sound suppression program involving a turbojet engine combustion chamber was recently conducted by Soundrive for one of the engine manufacturers to determine the feasibility of modifying the internal sound wave pattern, permitting construction of a lighter engine with better efficiency.

The complete jet engine was delivered to Soundrive and was excited internally with an electro-acoustic source to simulate internal sound existing under operational conditions.

Means of wave suppression were devised and incorporated in the engine. Resulting simplification of the sound wave pattern eliminated unwanted acoustics in certain regions and augmented desired acoustics in other regions. (Bodine says that under certain conditions sound waves can be beneficial to combustion.)

Investigation is still continuing, now under the sponsorship of the military which wants a reduction of noise from the tailpipe. A substantial part of this noise is generated internally, it is believed, although no definite amount can now be attributed to internal sources as compared with that caused by the mixing at the tailpipe of the jet and the surrounding air, Bodine says.

Surge Elimination

In another project on compressors, surge has been found to be an acoustic process. The surge can be eliminated, Bodine says, by eliminating the acoustics on the discharge side of the compressor. This is accomplished by installing low-frequency sound wave attenuators.

First phase of the work to prove this theory was done on an actual compressor for a major engine manufacturer. Next phase is to install the low-frequency attenuators in an operating engine. This will be an experimental job requiring a considerable amount of engineering adjustment in the attenuators to get best results.

A sonic burner has been developed

NEWS Edo NOTES

AMPHIBIOUS FLOATS PROVE STAMINA IN USE

Operating on rough gravel strips in the far north of Canada, a Cessna-Edo 180 amphibian has proven the rugged capabilities of the new Edo amphibious floats. Used in connection with the DEW-Line project, the Edo gear withstood grueling daily use with no difficulty whatsoever.

Since its introduction last spring the 180 amphibian, with a cruising speed of over 135 mph, has proven its exceptional performance under a wide variety of conditions. A 180 amphib has even flown from a Colorado lake 8,300 feet above sea level.

Inadvertent landings with wheels retracted have been made on at least five different occasions on both hard and soft runways with inconsequential results. Damage, if any at all, was confined to some wear on the keel strip, after which the plane was in the air within 15 minutes. Land and water landings were subsequently made without hitch.

To meet demand, production of amphibious floats has reached one per day in addition to production of standard Edo floats for Cessna, Piper and other aircraft. For more information send for new Edo float brochure.

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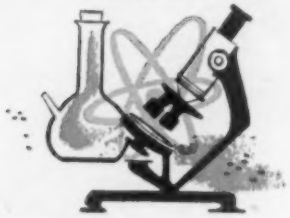
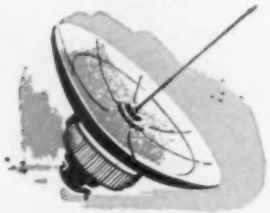
In Defense and Industry

RESEARCH



Applied Physics, Circuit Research, Solid State Physics, Low Temperature Physics.

RADAR

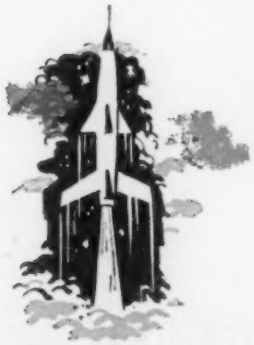


Transmitters and Receivers, Computers, Microwave Components, Pulse-Coding and Circuitry.

ELECTRON TUBES

Photomultipliers, Storage Tubes, Image Tubes, Infrared Tubes.

MISSILE



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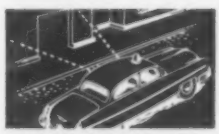
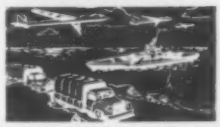


MOBILE PATROL SURVEILLANCE

FILM PROCESSING INSPECTION

MEDICAL BIOLOGICAL RESEARCH



MILITARY LAND-SEA-AIR APPLICATIONS

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thermal barriers
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• With each "boom" of a jet crashing through the sonic barrier, aircraft engineers give the sleeping dragon's tail another twist. Out there in space—which mankind has dedicated itself to conquer, lies the ugly, wallowing form of the next big challenge—temperature!
We manufacture many things for our air arm . . . precision gear assemblies for accessory drive units, actuators, transmissions, computers and controls . . . complete components such as bomb hoists, gun turrets, radar tracking and scanning assemblies, hydraulic actuators. But we're also hard at work on top secret equipment which, in the near future, will help arm our "flying St. Georges" as they slay the fiery dragon.
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and built at Soundrive to replace the conventional gas turbine combustion chamber.

The sonic burner would cut fuel consumption by converting some of the high-temperature thermal energy (which the turbine cannot fully utilize) into velocity energy which the turbine wheel can use directly in conversion to shaft horsepower.

Shape of the sonic burner is such that burning gases resonate acoustically and go through a high-frequency pressure cycle which results in augmented jetting of the gases toward the turbine buckets.

Detonation Control

Soundrive also is conducting a detonation control project for two oil companies. The project is concerned with control of sound waves in piston engine combustion chambers. The equipment used in this research is a CFR (Committee for Fuel Research) engine, a Pratt & Whitney R4360 cylinder assembly and a Wright R3350 cylinder assembly.

These units are fitted with acoustic attenuators and checked out on a bench with an electronically actuated system which generates a sound wave in the combustion chamber, whereby it is possible to simulate detonation.

The efficiency of the attenuators is checked to see how they suppress the sound. Results indicate that, by stopping the sound reflection in the combustion chamber, detonation can be eliminated.

It is believed that one form of attenuation to eliminate detonation might be a simple hole, of correct dimensions, in the piston crown.

This research is continuing at Soundrive.

Preliminary engineering discussions are under way between Soundrive and a British engine manufacturer with respect to gas turbine acoustics. The British manufacturer is planning to incorporate acoustical studies in its engine design program, possibly based on Soundrive data.

Various sound-absorbing materials such as porous metals, high-temperature fused silicon fibers, metallic wools and water spray with varying droplet sizes have been studied in Soundrive's sound tunnel, and some—porous metals, stainless steel wool and silicon fibers—have been applied to actual engine combustion chambers.

Bodine's background in acoustics is extensive. He is the inventor of the ultrasonic dental drill, now entering the clinical stage of use, he says, as well as an acoustic oil-well drill being developed by Borg-Warner. A sonic oil well pump developed by him now is undergoing tests by various oil companies.

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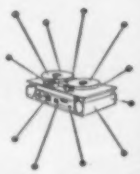

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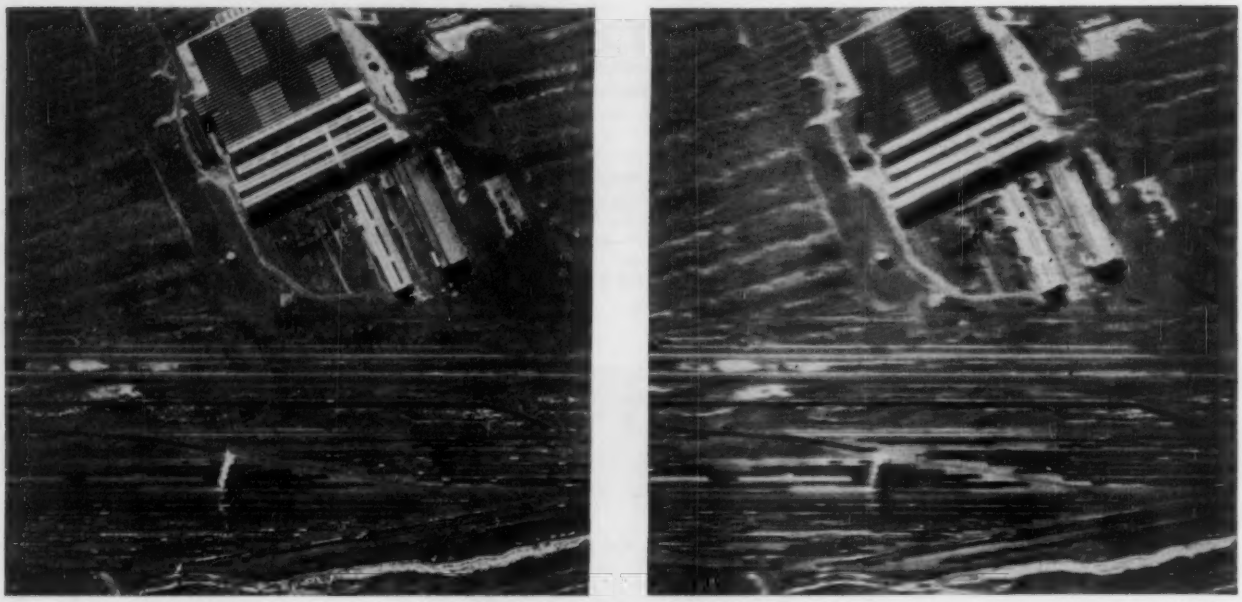


BOTH PHOTOGRAPHS shown above were taken at the same altitude and airspeed cameras using identical shutter speeds. The difference: Left photo was taken by camera equipped with image-motion compensation system.

New Cameras Keep Pace With Supersonic

By George L. Christian

Chicago—Today's electronically-assisted photo-reconnaissance pilot can accomplish tasks that formerly would have required the attention of 10 qualified aerial photographers. He can do most of this by simply throwing two cockpit switches.

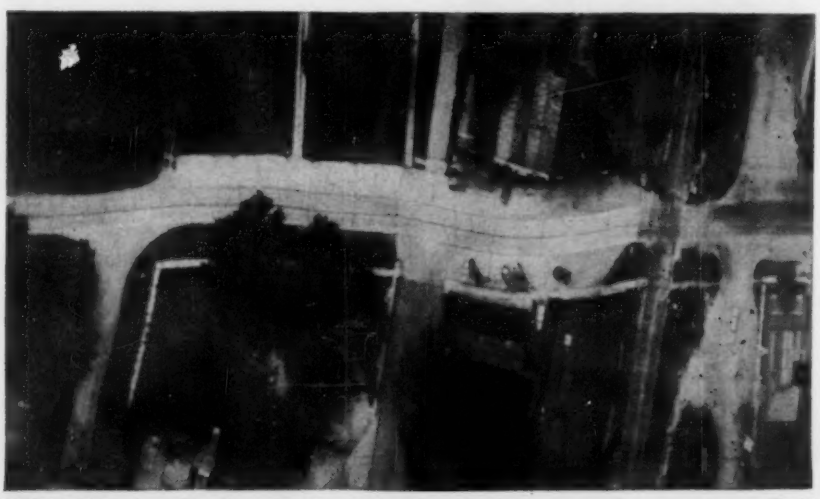
The specialized camera systems, hidden away within the plane's fuselage and nose, include equipment that compensates for image motion (a must in supersonic reconnaissance), integral viewfinders, high-altitude scanners and Precision Automatic Photogrammetric Intervalometers.

One of the largest producers of this equipment is the Chicago Aerial Industries, headed by Fred Sonne, a pioneer in the field.

One Out of 10

Today, 10% of all military combat aircraft being built are reconnaissance versions of fighting types, according to the USAF, and photo reconnaissance has become important enough for the Air Force to call for a high-speed aircraft built especially for such work. Three aircraft manufacturers, including Bell, are competing for the contract.

Among new military jets already being produced in photographic versions are the RF-101, RB-52, F11F-1P and F8U-1P. Others are coming up. Planes currently flying with CAI equipment include the RB-47, RB-57A, RF-84F, F7U-3P and F2H-2P.



HIGH-SPEED, low-altitude strip photo showing distortion (note the wave in roadbed) due to flight disturbance. Gyro stabilizing largely eliminates this.

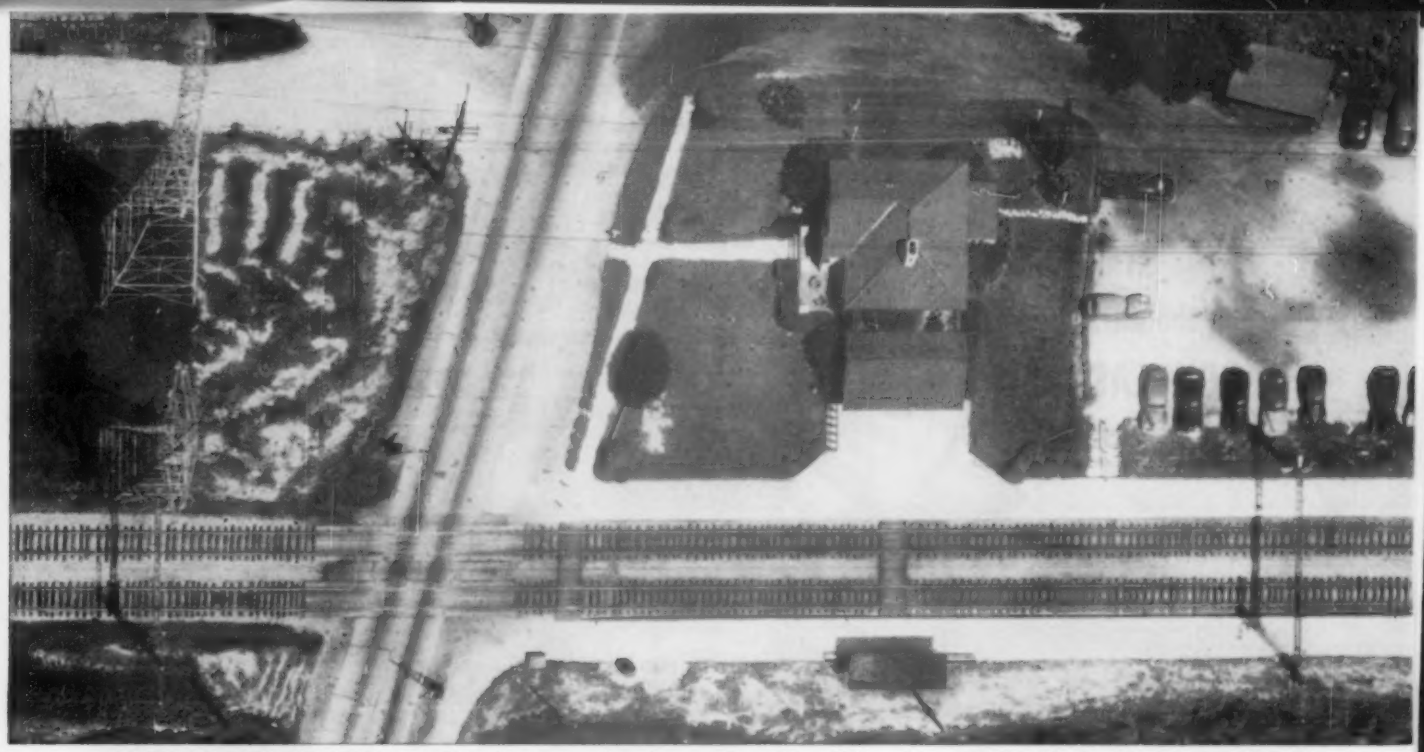
New Developments

CAI refinements of aerial photographic control systems, components and cameras now make it possible to map large land areas and to produce sharp pictures from planes flying at speeds and altitudes which would have meant blurred photographs a short time ago.

The NCCS-4 (Navy Camera Control System) incorporates many of these refinements.

Samuel Bousky, CAI's assistant to the president, says the NCCS-4 system "promises increased reliability, greater simplicity and better accuracy with extended ranges and functions." Plans are in progress to install this system on new aircraft being made by McDonnell, Grumman, Douglas and North American, he said.

Automatic functions performed by



SONNE CONTINUOUS STRIP CAMERA photo was taken from a plane flying 500 mph. at 250 ft. altitude. Top of power-line tower is blurred because movement of film was synchronized with ground movement.

Demands

the camera control system include:

- **Scanning.** This system senses the plane's speed altitude ratio.
- **Image motion compensation.** The film for still pictures is moved in its platen at a speed synchronized with the plane's speed/altitude ratio to prevent blurring during high-speed, low-level reconnaissance runs. IMC-synchronized film movement was adapted from the Sonne-developed continuous strip camera.
- **Cycling rate of sequential cameras** is adjusted so successive pictures are automatically taken with correct overlap.
- **Exposure control** automatically sets diaphragm opening and selects the fastest shutter speed for existing light conditions. The pilot can over ride the control, deliberately over or under-exposing pictures by one or two f-numbers (stops) to compensate for unusually dark or light subjects. A small indicator on the plane's instrument panel permits the pilot to select the exact exposure he desires.
- **Release of photo flash** bombs for night photography is automatically sequenced and synchronized with camera shutters. The system also recycles cameras after each exposure.
- **Compensation for shifting** a camera from veritcal to oblique positions (or vice versa) is done automatically.
- **Azimuth correction** for plane drift is

SONNE STRIP CAMERA being loaded into F9F Navy fighter. Note viewfinder in cockpit.

BENEFITS NEVER BEFORE POSSIBLE

- **no annoying ear-popping**
- **simple controls — automatic, reliable**
- **far less maintenance**
  No sensor contacts or filters to clean.
- **completely electrical**
  No complex tubing.
- **lower cost**
- **lighter weight**
  As much as 60% lighter!
- **easily retrofitted in any existing aircraft**
- **particularly adaptable to future high performance air transports**

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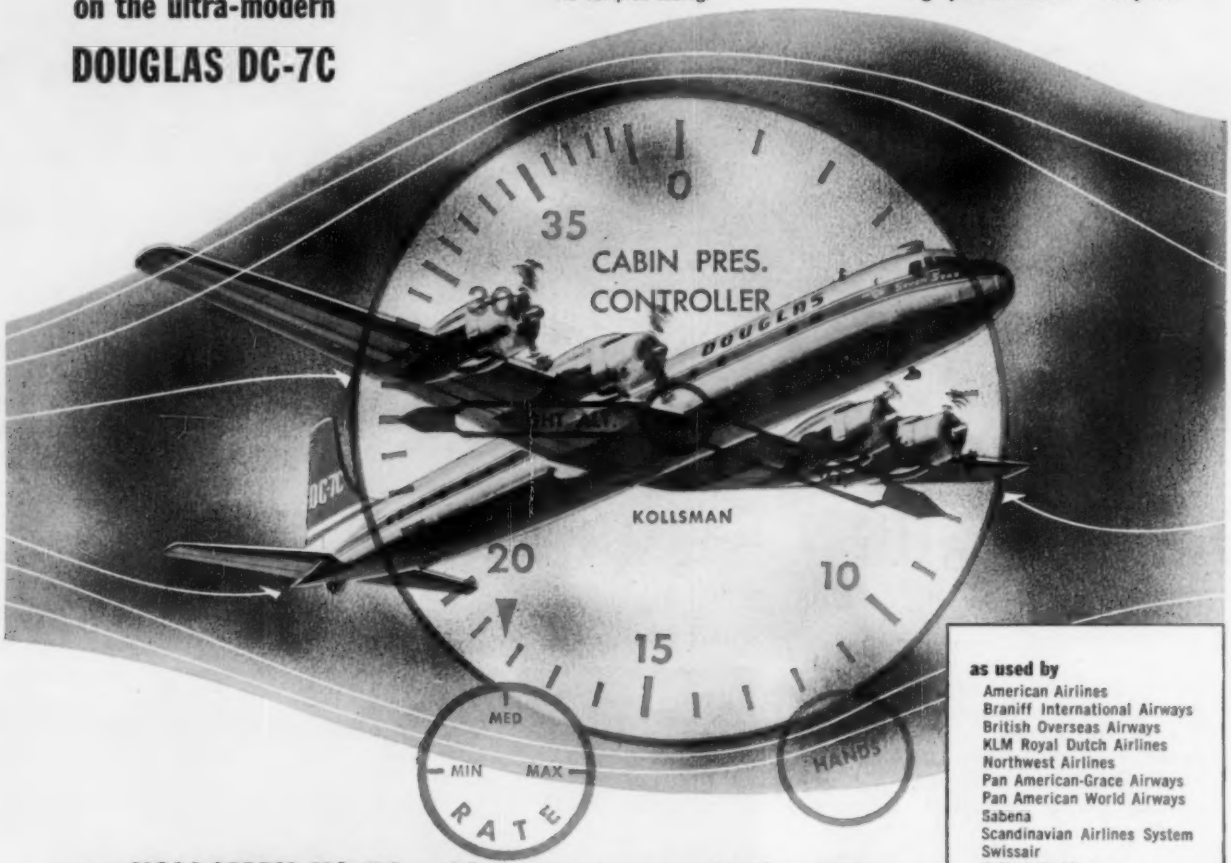

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PEACE OF MIND IN THE COCKPIT . . . When the controls are set, the system is fully automatic and thoroughly reliable — especially so because of the simplicity of the Kollsman design.

NO WORRY IN THE MAINTENANCE SHOP . . . The components are simple and rugged, proven dependable and require a minimum of maintenance. There are no sensor contacts or filters to clean, no complex tubing to worry about.

WRITE for special folder giving full technical details on the new Kollsman KS-54 System, or ask to have a sales engineer visit you.

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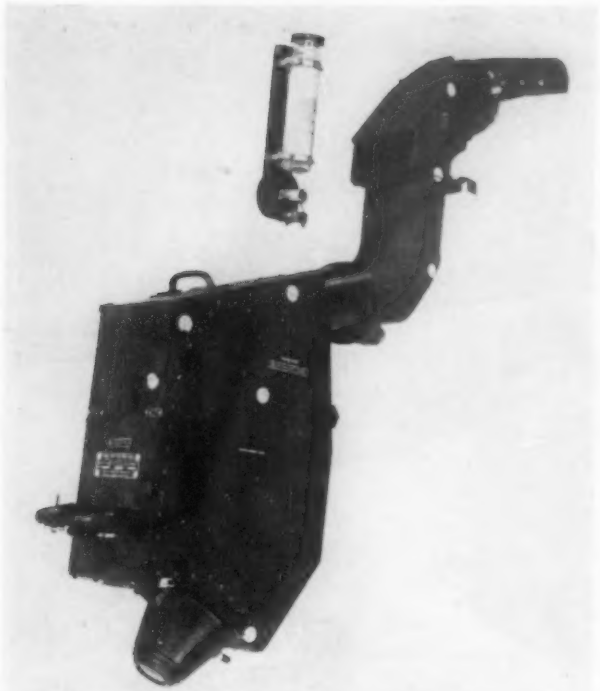
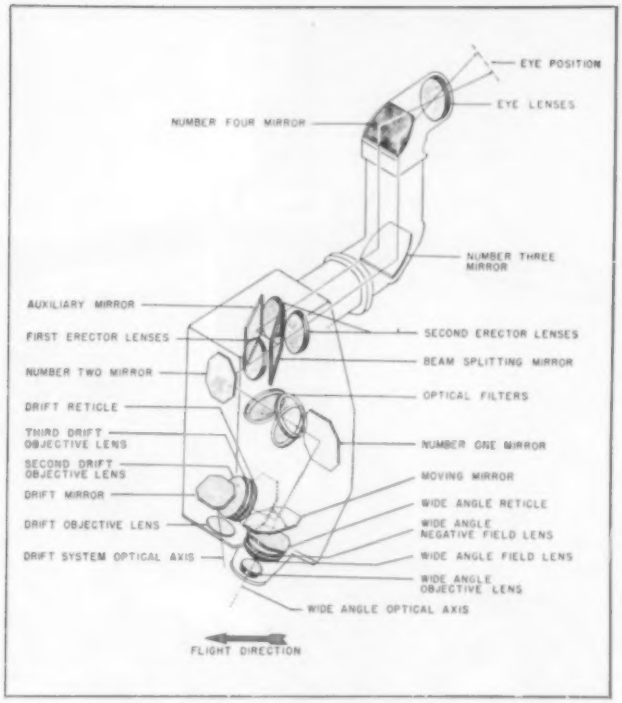




TYPICAL VIEWFINDER manufactured by Chicago Aerial Industries at left. Drawing at right shows viewfinder's optical system.

automatically determined and compensated for.

Automatic Scanner

The automatic scanner is an essential adjunct of the continuous strip and the image motion compensation still cameras. This device synchronizes film speed movement with the speed of the aircraft, while taking into consideration its altitude above the terrain being photographed.

Until recently, 12,000 to 15,000-ft. has been the maximum altitude at which the scanners would work. But a new gyro-stabilized model now going into production will push the maximum operating altitude up to the 60,000-80,000-ft. range. Gyro stabilization greatly reduces the scanner's sensitivity to angular velocity—.001 radians/sec. at 50,000 ft.

The automatic scanner is a 2x4x8-in. unit containing two lenses which scan the ground over which the plane is flying. The lenses form images of the ground on two small grids consisting of alternate transparent and opaque bars .010 in. wide on the surface of a glass plate. As ground images move across the grids, photoelectric cells behind the grids receive alternate light and dark impressions from contrast variations in the image caused by the changing panorama of the earth's surface passing under the plane.

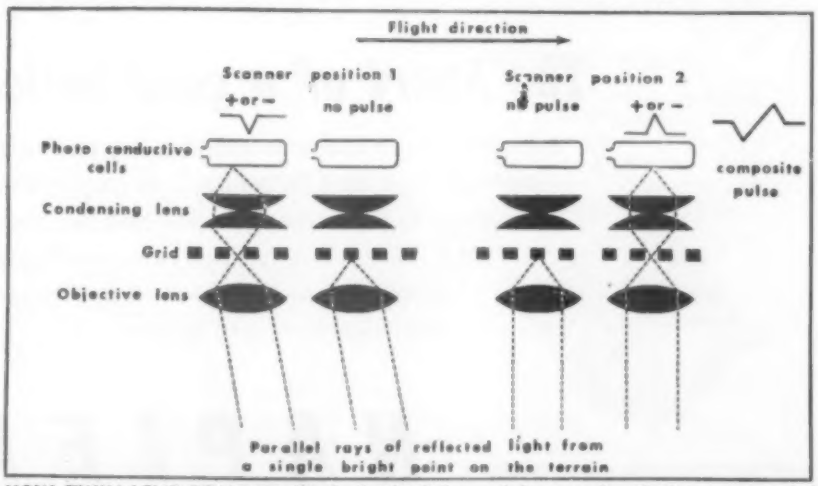
Use of two lenses and grids enables the system to cancel out sudden changes in ambient light level. For example, if the plane is flying over a large dark area such as a forest and suddenly crosses a light concrete highway, the brightness of the concrete's reflection produces a large change in light level which interferes with the device's output signal. But the two grids are phased so that the sections of image falling on the clear areas of one fall on the opaque areas of the other. Therefore, as light transmitted through one grid increases, light transmitted through the other decreases, resulting in a canceling effect.

Frequency Converter

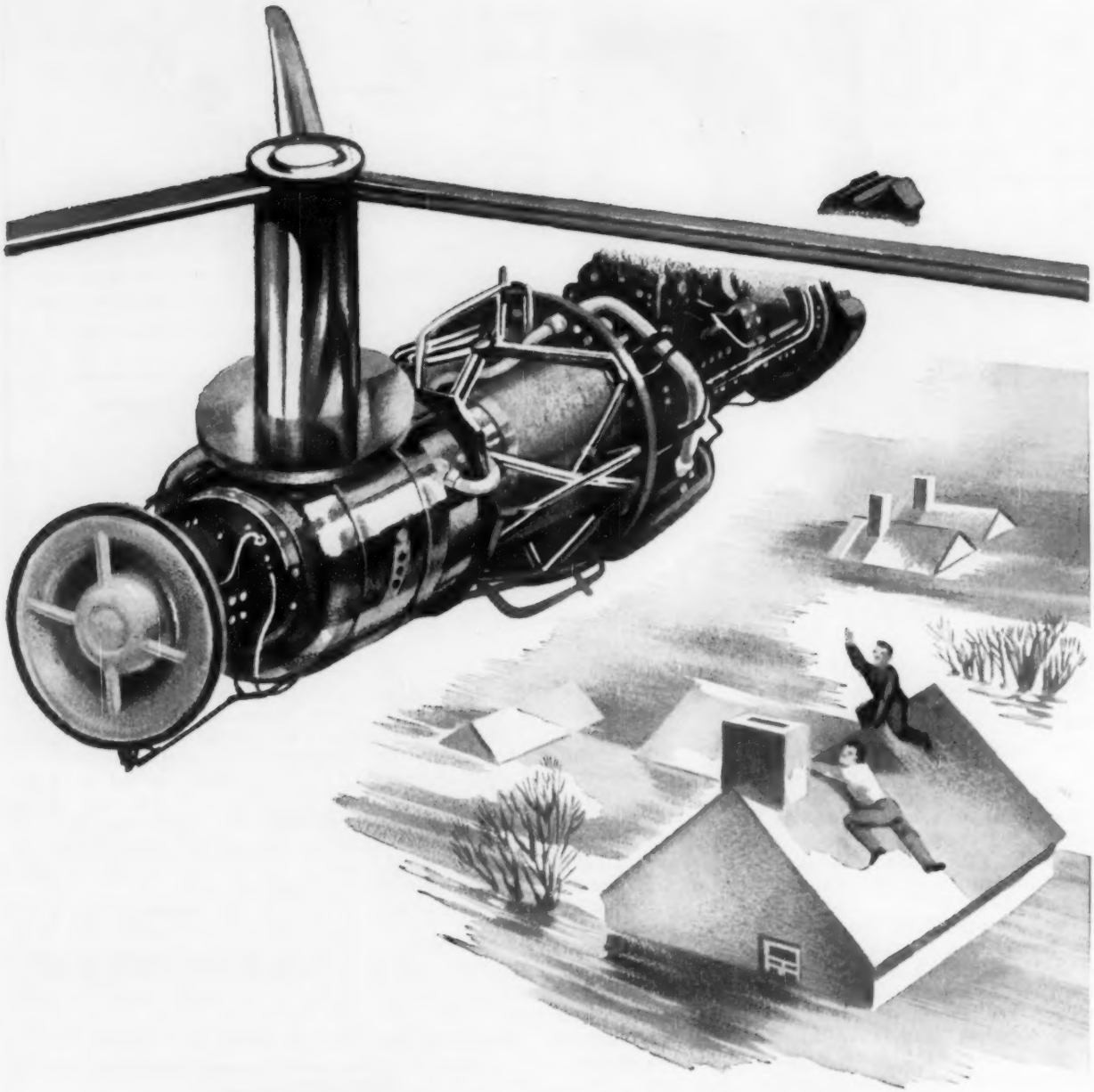
Contrast variations of the earth's surface, focused on the photoelectric cells, produce electrical frequencies—the faster the image moves across the two grids, the higher the frequency signal. Thus, frequency generated is proportional to the ratio of aircraft ground speed to aircraft altitude.

Frequency signals are fed into a special converter which does these things:

- **Evaluates the signals** and rejects all extraneous ones, selecting only the frequency proportional to the aircraft's speed/altitude ratio.
- **Converts the frequency** into a d.c. voltage proportional to this ratio. Voltage is supplied to the camera control system which governs all camera drives.
- **Uses a "memory" circuit** to retain the last signal received and keeps feeding a fixed voltage to operate the con-



HOW TWIN-LENS SCANNER blocks bright light: at left, second grid closes out angled light. First grid does the same with direct light (right).



The heart of a good helicopter

A helicopter engine that works without driving shafts and driving gear—that's the Napier Oryx. It's a 750 gas h.p. turbo-gas-generator, designed for helicopters propelled by jet reaction at the rotor blade tips. It weighs less, it's less complex and it's easier to maintain than conventional helicopter power systems. The Oryx is a step forward—and upward—in helicopter propulsion, and an engine of great importance to helicopter operators.

NAPIER **Oryx** turbo gas generator

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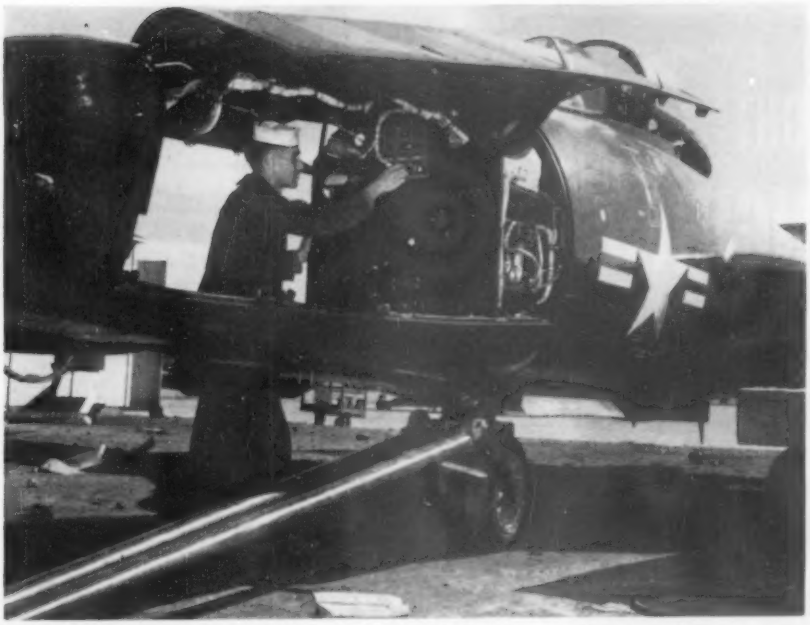
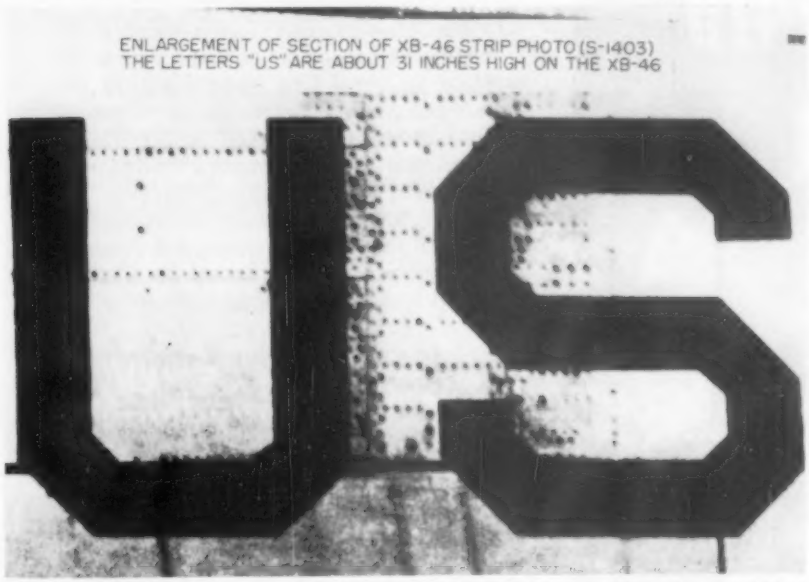


NOSE SECTION of Banshee lifts for servicing of photo-reconnaissance equipment.



RIVET PATTERN shows clearly in enlargement of photo taken at 450 mph. and 100 ft.

trol system in case of signal loss which might occur if the plane flies over no-contrast areas such as unbroken stretches of sand or dead calm water. The memory circuit holds the voltage constant for at least five minutes or until the scanner again picks up reliable light signals.

Image Motion Compensation

A 500-mph. plane travels 6-7 ft. during a 100th-of-a-second exposure, making provision necessary against blurring.

CAI technicians, having already solved the problems of synchronizing film and aircraft speeds for the continuous strip camera, adopted the same basic principles to the magazines of their sequential still cameras.

IMC receives its signals from the scanner and moves the film-holding platen in the magazine in synchronization with the plane's speed/altitude ratio during film exposure. The result is a picture as sharply defined as though the camera were motionless.

Recent improvements in both Air Force and Navy magazines include substituting an electronic drive for the previously-used mechanical drive and newly developed features for automatically controlling the operation of airborne photographic equipment.

Essential to the success of a photo reconnaissance mission being flown by

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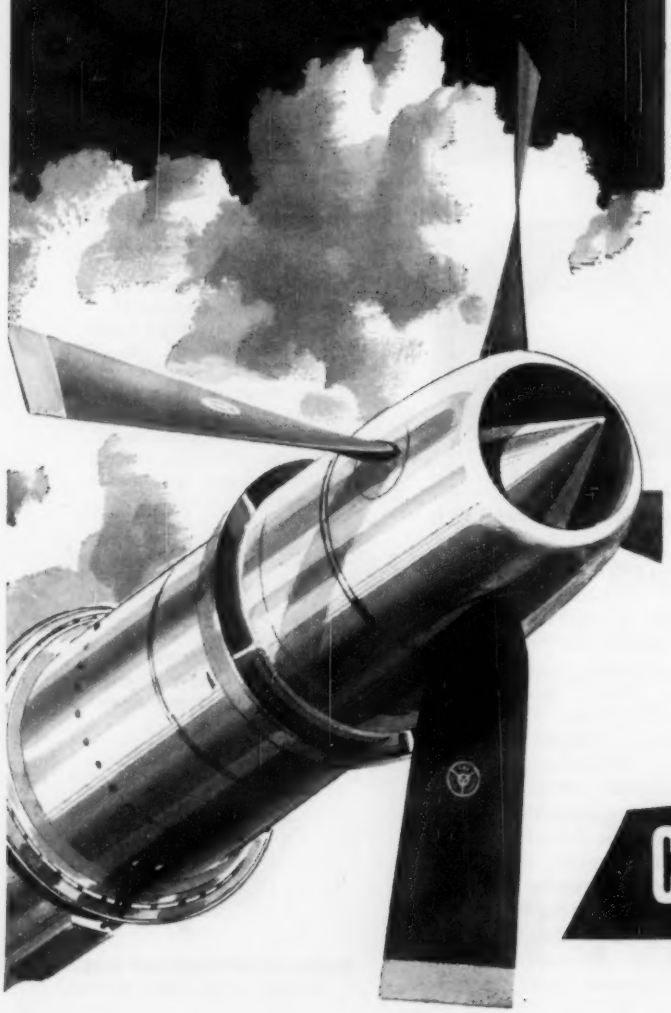
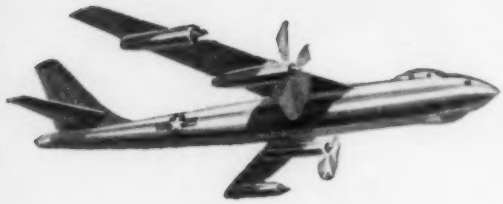
TURBOPROP ENGINES and TURBOLECTRIC PROPELLERS power the BOEING XB-47D





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The Boeing XB-47D is the latest in a series of operational aircraft which are providing the Air Force with vital logistical data.

In the XB-47D, two Curtiss-Wright T49 Turboprop engines—most powerful ever to fly—replace the usual four inboard jets, as the aircraft explores the range and speed potentials of turboprop power. And these T49's are equipped with another advanced development—Curtiss-Wright Turbolectric propellers.

This engine-propeller team is symbolic of the forward-thinking engineering and development program which has earned for Curtiss-Wright its leadership in world aviation.

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Yewkus Automatic Camera System

Bill Jack Scientific Instrument Co.'s Yewkus does a job similar to that of Chicago Aerial Industries' automatically controlled airborne cameras.

Yewkus (short for Universal Camera Control System) was tested and approved by the Air Force a year ago and is now installed in more than 200 reconnaissance aircraft, from RB-26s to RB-47s.

Electronic components are packaged in standard-sized metal modules, which allows control systems to be built up as needed and gives the designer flexibility in disposing components in available space.

The company says the Yewkus system can handle any number or size of cameras that normally go into a photo-reconnaissance design. It will take cameras with negative sizes ranging from 2¼ in. square to 9x18 in., and with lenses having focal lengths from three to 36 in. and longer.

Yewkus automatically activates up to five cameras per station by the flick of a couple of switches. It also controls release of flash bombs or cartridges for night photography and incorporates a "memory circuit" which memorizes the pyrotechnic drop patterns to open camera shutters just before illuminant explodes. Safety circuits turn on warning lights if cameras are inoperative or if bomb bay doors are closed when cameras are turned on.

A typical installation in a fighter-type reconnaissance plane weighs 145 lb., occupies 3.25 cu. ft. and costs $10,000 in quantities of 100 or more.

a single-seater, fighter-type plane is a means of allowing the pilot to view the ground clearly without having to maneuver his plane excessively.

To meet this need, Chicago Aerial developed its viewfinder, over 1,500 of which are now in service. Bousky says that virtually all reconnaissance planes, present and future, will mount it.

CAI-designed viewfinders are complex optical devices which present large (6-in.-diameter) binocular images on a viewing lens mounted in the center of the instrument panel where the pilot can watch the terrain over which he is flying without having to shift his gaze out of the cockpit. Moreover, he can keep his plane flying straight and level at all times, since he no longer has to bank to find visual check points on the ground.

High-transmittance, clear-resolution binocular images appear on the viewing lens. Binocular images are provided by a beam-splitting device whose purpose is to avoid differential image distortion and eliminate eye strain.

Latest CAI development for viewfinders is an illuminated, traveling grid superimposed on the image on the viewing lens. The system, just going into production, allows the pilot to manually synchronize movement of the grid with movement of the ground image. Once synchronized, the viewfinder can be integrated with the camera control system and act as an imput mode. Thus, the grid-equipped finder can double for the scanner in case the latter fails or becomes temporarily inoperative when overflying broken clouds. It also works in semi-darkness when the scanner cannot function or can serve as a check to make sure the scanner is operating correctly.

The viewfinder also allows a pilot to lay his track line and determine its position in the area to be photographed far ahead of his aircraft's position. He may align himself with this track line even if his plane has a drift heading set into it. This allows him to obtain the drift angle to use for navigational purposes and to correct for camera azimuth.

Etched grid lines, superimposed on the image, show the pilot the coverage of his more important cameras, permitting him to know exactly what terrain he is photographing.

Viewfinder Operation

CAI viewfinders have been designed with a variety of characteristics. Most units have at least a forward and a vertical viewing lens.

The forward viewing lens allows a pilot approaching his objective to keep it in view after over-the-nose visual contact is no longer possible. This lens usually covers an 85 deg. field—from 80 deg. forward to 5 deg. aft.

The vertical viewing lens normally covers a 30-deg. angle directly below the plane. A switch is provided to change from one lens to another through an electrically actuated mechanism.

Refinements incorporated in today's finders include provision for blacking out the image to avoid distracting the pilot during such maneuvers as landing and a filter which can be interposed to increase visual acuity in the presence of haze.

Special purpose viewfinders have been built with mechanisms which provide several different viewing positions and angles by rotating a turret and prism. Others have fields of view as large as 100 deg.

Viewfinders are tailored to the air-

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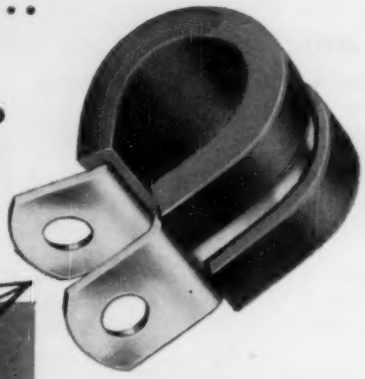

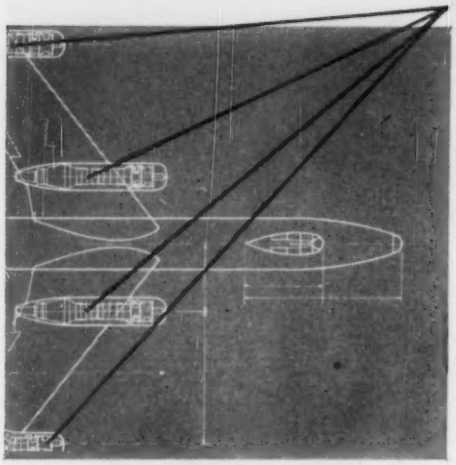

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craft they go into. The devices are large, posing a problem of fitting them into jet fighter planes where the entire nose may be used to house the engine intake air duct. In at least one installation. CAI engineers had to devise a method of "looking through" the duct.

Light is transmitted through the viewfinder by means of a complex optical system of lenses, prisms and mirrors. Major optical problem in making viewfinders is the elimination of distortion and parallax.

Bousky summed up these other tough mechanical posers:

- **Building structural rigidity** and precise optical alignment into viewfinders, yet keeping their weight to a minimum.
- **Stopping moving optical components** in exactly the same position each time they are shifted.
- **Supporting lenses, mirrors** and prisms rigidly to withstand vibration and shock. Navy aircraft impose particularly severe problems because of high stresses and shock resulting from catapult takeoffs and arrested landings.

Night Photography

To run a night photography mission, a pilot sets altitude and speed values into the camera control system and flips the "operate" switch. An interval controller computes the time interval required between successive bombs or flares and provides the pulses to release them at the correct rate.

The camera shutter is opened and waits. An electronic flash detector "sees" when the flash occurs and closes the shutter. The magazine recycles the film and the shutter reopens, waiting for the next flash.

Timing is such that the pyrotechnic explodes outside of the angular view of the lens by several degrees to avoid light-striking the film.

Cycles are repeated automatically without any further attention from the pilot.

When the mission is completed, the pilot turns off the switch. Illuminant release stops instantly, but the remainder of the control system is kept in operation by an overrun control. This assures that pictures will continue to be made with any unexploded illuminants still in the air when the switch is turned off. Pyrotechnics used in night photography are either cartridges (flares) or bombs. The former are relatively small, (1¼-in. diameter and 8-in. length) produce about 100 million candlepower and are for low altitude work. Bombs may measure 8 in. in diameter, be 4 ft. long, and weigh 150 lb. They develop a peak flash intensity of almost 4 billion candlepower and are used at altitudes ranging from 6,000 to 20,000 ft.

CAI innovations in the field of aerial

Two Aerojet-General high-thrust, short-duration solid propellant rocket powerplants boost the Navy's famed REGULUS missile off on its mission.

Built by Chance-Vought, the REGULUS is one of a growing number of available missiles for defensive or offensive applications.

This booster was tailor-made for REGULUS. Proven reliability, producibility and low cost make it another example of Aerojet-General's unparalleled experience in development and production of rocket powerplants.

Aerojet-General supplies liquid and solid propellant rocket powerplants, auxiliary power units, gas generators, or other associated equipment to a major part of America's missile program.

Since the first JATO was produced by Aerojet-General in 1942, the company has delivered over 350,000 JATOs and boosters ranging in thrust from 250 pounds to 100,000 pounds.

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Third is the use of quality materials in all LORD products — each selected and proved for maximum performance.

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photography through the years include:

• **PAPI (Precision Automatic Photogrametric Intervalometer),** a new device which is now being flight tested. PAPI combines in a single instrument the elements of a high-altitude scanner system with an electronic intervalometer. The device provides precise pulses to operate mapping cameras so that image overlap (required for stereoscopic photography is controlled within very narrow limits. First flight tests indicate that a nominal 60% overlap can be maintained within 2-3% over rapidly changing terrain.

• **Continuous strip camera,** invented by Sonne over some 23 years ago, was the first important development made by the company in the field of aerial camera equipment.

The Sonne camera "paints" a continuous photographic panorama on a long strip of film which is moved past a slit at a speed synchronized to the plane's speed/altitude ratio by a scanner. Gyro stabilization corrects for any flight disturbance caused by turbulence.

The purpose of the camera is to take long strips of pictures from fast, low-flying aircraft.

The importance of the continuous strip camera to aerial photography is growing rapidly as aircraft speeds increase to the point where sequential cameras cannot cycle fast enough to keep up with the passing terrain. To date, Sonne says, the strip camera is capable of keeping up with the fastest photo-reconnaissance plane flying. The camera whips film past the slit at speeds up to 2,000 in./sec.—equal to about 114 mph. Moreover, Sonne believes the strip camera will be able to keep pace with any reconnaissance planes which will be flying in the forseeable future. "There is hardly any limit to what you can do with continuous strip photography," he says.

• **Sonne strip printer** allows 10,000 strip prints a day to be made instead of the daily maximum of 100 prints before development of the new printers.

Early Days

Chicago Aerial Survey Co., predecessor to Chicago Aerial Industries, was organized in 1923 by Sonne and Eugene W. Fuller, both of whom were pilots.

The new company first operated with planes owned by Sonne. These included a Curtis JN-4D Jenny, a C-6 Standard J-1, a Thomas Morse Scout and a German Rumpler. First company-owned plane, acquired in 1938, was a Fokker Super Universal.

In 1932, Sonne conceived the idea of the continuous strip camera, where instead of panning the camera to keep pictures clear, the camera was held stationary and the film moved past the lens in the same direction and at the

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2) Experience in the development of missile telemetering systems.
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same speed as the image motion.

He modified an Eastman K-1 aerial camera to include a slit and a hand-driven crank. He also devised a finder with a moving grid with which to synchronize film movement.

A demonstration for Army Air Corps officers at Wright Field resulted in an order, which was filled in 1939. Following this, production was moved from Sonne's workshop into a factory where the camera could be built in quantity. Engineers, draftsmen and mechanics were hired and the program got underway.

In 1940, CAI had five employes and sales for the year of $9,000. This year, personnel numbers over 500 and estimated gross will be $8 million.

OFF THE LINE

Anderson Structural Co. of Los Angeles has recently built all-steel hangars of similar design for Lear, Inc., at Clover Field, Santa Monica, Calif., and Grand Rapids, Mich. Translucent Fiberglas skylights molded to fit the ribbed steel roof decking provide diffused light for the hangars.

General Electric Co.'s Plastics dept. has announced a 3 to 5% increase for such items as injection and compression molding, silicone rubber and GE Mycalex products.

An Adkins Relative Danger Light (AW Oct. 3, p. 78), installed on a Northwest Orient Airlines' DC-6B, has operated for about 200-hr. with only two minor malfunctions—a spring clip broke and a triggering mechanism transformer failed. Pilots report that the light can be seen easily at a range of 75 miles on a clear night.

Delta Air Lines has converted all of its non-highway, non-load-carrying automotive equipment such as tugs and energizers to use liquefied petroleum (LP) gas, expects to save $320 per vehicle each year. Average cost of conversion is $150 a vehicle. Previously KLM Royal Dutch Airlines had converted to LP gas.

Cat-A-Lac paint on airborne radar radomes has solved problem of rain erosion, says PAA. Radomes on DC-6Bs and -7Bs formerly had to be replaced after 300-500 hr. Cat-A-Lac is made by Finch Paint Co., Gardena, Calif.

Performance comparison of DC-3s with P&WA R1830-92 and R1830-94 engines is available from Steward Davis Inc., 13501 S. Western Ave., Gardena, Calif.

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Turbopump Requires No Controls

By Irving Stone

Burbank—A pneumatic-driven fuel transfer pump powered by bleed air and requiring no controls has been developed for jet aircraft service by Hydro-Air Inc.

First application of the turbopump is in a new Douglas plane as a tank-mounted submerged unit. Another version is being built for evaluation testing on the FJ4 by North American Aviation's Columbus division.

Weight of the new turbopump package is 10 lb. Capacity is 26,000 lb. per hour (65.6 gpm.) at 9 psi., utilizing turbojet engine bleed air at 5 lb. per minute.

The package is now out of the development stage and is in production.

Continuous Operation

Outstanding feature of the unit is that it operates over the complete range of engine bleed air conditions and fuel flow requirements and also in a dry tank, with no controls. There are no pressure- or speed-sensing devices, shut-off valves or actuators.

So long as the engine is operating, the pump will continue to operate without attention.

With the tank dry and the pump load removed, the turbine runaway speed does not exceed the mechanical limitations of the unit.

Normal operating speed is 12,000 rpm. under load, and 25,000 rpm. with a dry tank.

The turbopump has completed 200 dry-run qualification tests in cycles ranging from 30 minutes at 350F bleed air temperature down to shorter time intervals at higher air temperatures.

The unit has been tested, while pumping, for 1,200 simulated flights to altitudes above 50,000 ft. It is designed to re-prime, after being uncovered and run dry, with only ½-in. inlet submergence, at all operating altitudes.

Housing temperature of the turbopump is safely below the auto-ignition temperature of the fuel under all operating conditions.

The maximum case temperature reached during qualification tests of the turbopump was 315F.

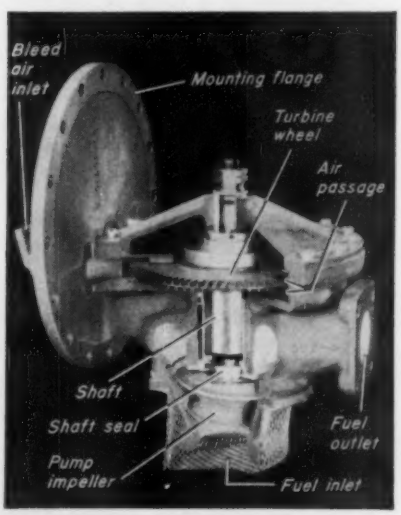
Turbopump Features

Hydro-Aire points out that the bleed air drive offers the following advantages, in addition to the no-control feature:

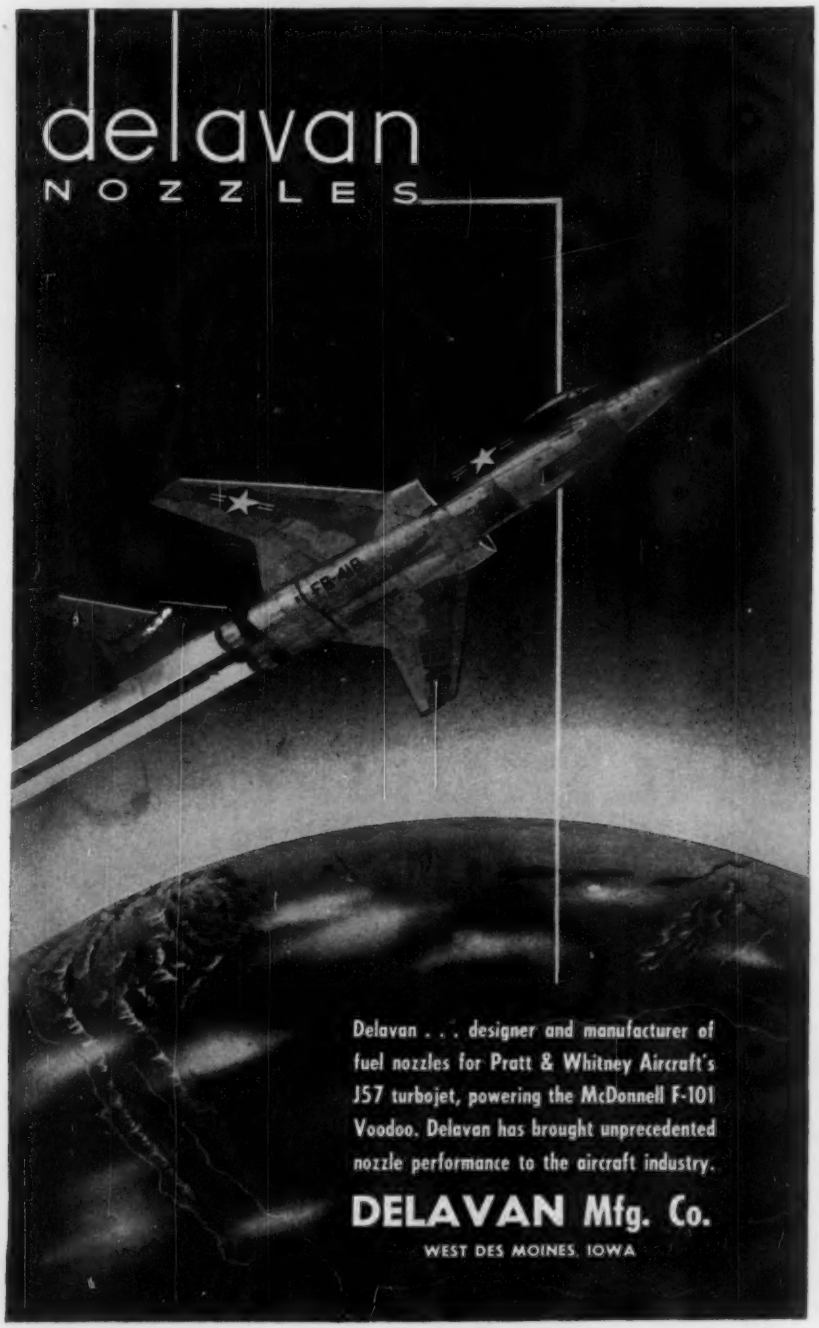
• **Greater reliability.** The pump is not subject to electrical failures, since power source is directly from jet engine bleed air.

• **Weight savings.** There will be a weight saving on the plane if the bleed air ducting required for the turbopump weighs less than a separate power source and controlling equipment need for the electrically driven counterpart.

In normal installations, a Hydro-Aire spokesman points out, the turbopump may be located close to the source of



BLEED-AIR fuel transfer pump cutaway shows turbine, impeller and shafting details.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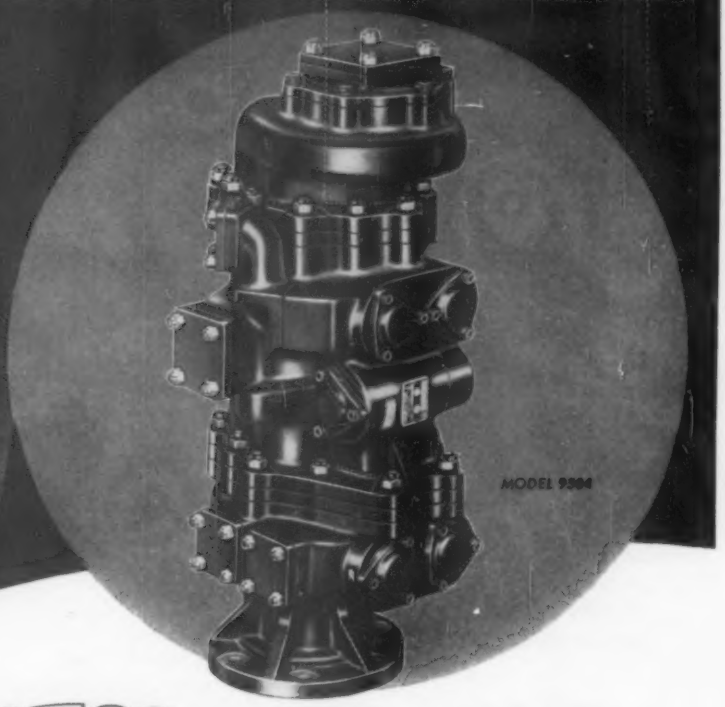


...and the CECO SERVICE RECORD *proves it!*

Not by unsubstantiated claims . . . not on the drawing board . . . but by thousands of dependable hours *in the air* under every conceivable flight condition, CECO Fuel Pumps have *proved* there *is* a big difference in pump performance.

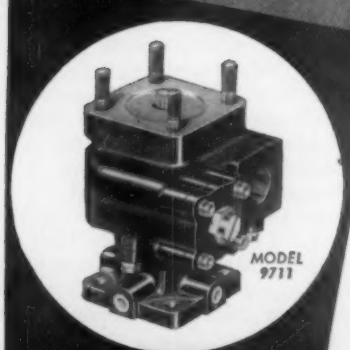
And there are good reasons behind this difference:

GEARS . . . To eliminate the "white layer" problem, CECO gears are made of Nitralloy Steel, hardened, and the teeth *ground* (not shaved) . . . the result is maximum durability and accuracy.

BEARINGS . . . are fully supported and plated with "shoeblack" . . . an exclusive CECO material and process that insures longer life, minimizes maintenance.

ALIGNMENT CONSTRUCTION METHOD . . . Components are centered in a common bore, easier to disassemble and reassemble for routine maintenance; no complicated re-alignment is required.

If a bonus in performance can help your present projects, send for more detailed information about CECO Pumps . . . and about completely integrated CECO Fuel Pumping and Control Systems. Ask for your copy of "Engineered For The High And The Mighty . . ."



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Microloc Corp.

5300 West 104th Street, Los Angeles 45, Calif.

Typical of the advanced research and development projects currently being carried out successfully by Kaman Aircraft is this drone helicopter. The technical problems of remote control are more complex with a helicopter than with fixed-wing aircraft because of the 'copter's ability to fly in every direction at varying speeds, as well as to hover in flight. Kaman engineers solved these complicated problems by designing an entirely new electronic control system, miniature mechanical system and small automatic pilot. Kaman is proud that most of its 10 years have been devoted to the National Defense effort to keep the free world free.

KAMAN

THE KAMAN AIRCRAFT CORP., BLOOMFIELD, CONN.

the bleed air to minimize length and weight of ducting.

• **Alleviates shortage** of electrical power. Since the turbine operates on bleed air, no additional drain is placed on what already might be an acute electrical load.

• **Variable speed** enables turbopump to match the operational needs of the plane more closely than does a constant-speed electrically operated pump. The turbopump's speed and output decreases with the increase in altitude, keeping pace with the jet engine's lessened fuel demand, Hydro-Aire says.

Internal Details

The turbine consists of a single aluminum alloy 5-in.-diameter disk (in the Douglas application) with integral blades. The simple blading permits manufacture by machining, casting or forging.

Aerodynamic characteristics of the turbine section are such that runaway speeds cannot exceed 25,000 rpm. with the specified bleed air conditions.

The pump impeller is of the same type used in the company's electrically operated transfer pumps.

Impeller and turbine wheel are integrally mounted on a hollow shaft supported on grease-lubricated ball bearings inside the shaft.

Fuel side of the turbopump is separated from the air section by means of a carbon-face type shaft seal. In the event of fuel leakage past this seal, the fuel is drained off at a low point before it can reach the bearings and cause lubrication failure.

Turbine exhaust is piped immediately overboard beneath the wing.

The package is designed to operate 1,200 hr. without maintenance, Hydro-Aire says.

Gulf Develops New Piston Engine Oil

A new aircraft engine oil for business and private aircraft powerplants is being marketed by Gulf Oil Corp. It is designed for use with both radial and horizontally opposed engines.

The new lubricant replaces Gulf's Series R aircraft engine oil. It comes in SAE grades 30, 40, 50 and 60, and is packaged in quarts and drums. It is a high-quality, straight mineral oil, developed from a new blend of crude oil stocks and refinery processes, Gulf says.

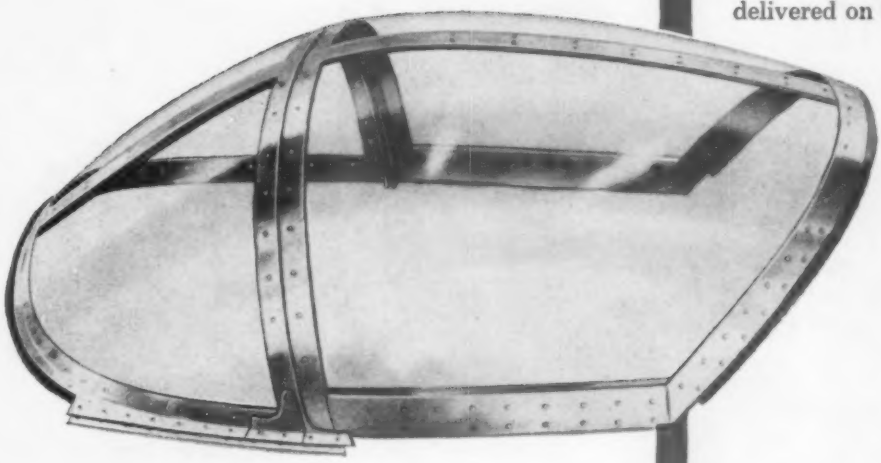
The company claims the new oil improves engine cleanliness, reducing rocker box coking and deposits on oil inlet screens.

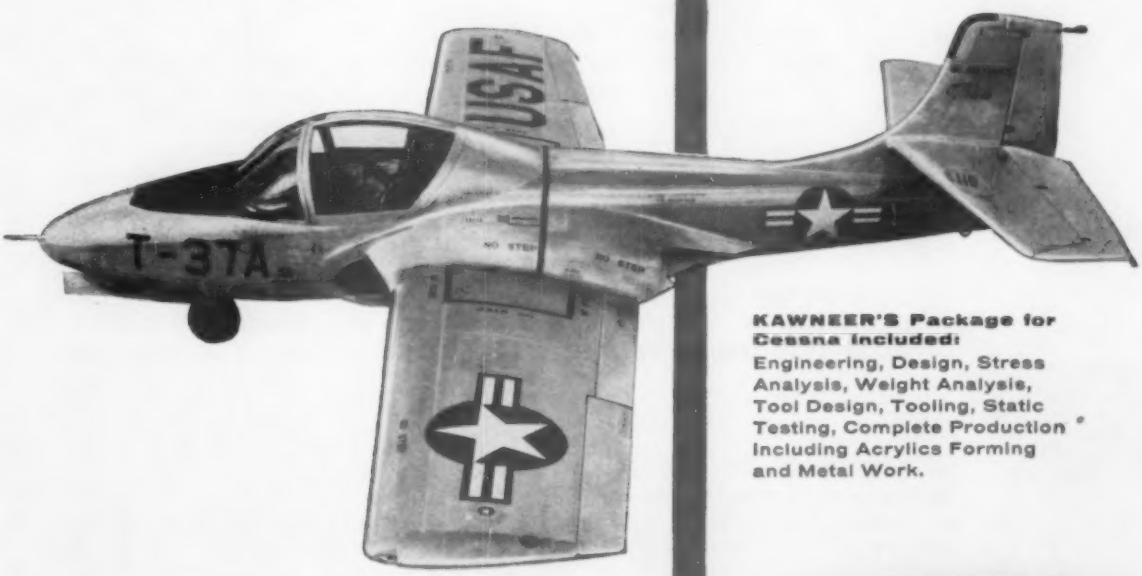
The oil has been approved by Civil Aeronautics Administration, based on service approvals by Pratt & Whitney Aircraft and Wright Aeronautical Division.

Kawneer "package" service provides economy in Cessna Cockpit enclosure

Kawneer provides quality, economy and delivery again! Last Fall Kawneer started the Cessna T-37 side-by-side cockpit enclosure project and delivered the first unit this Spring. This "on schedule" procedure was possible because Kawneer has formed an integrated "package" of engineering, design and production in the cockpit enclosure field.

As specialists working with acrylics and metal in the production of cockpit enclosures, Kawneer offers you quality products, economically produced and delivered on time.





KAWNEER'S Package for Cessna Included:
Engineering, Design, Stress Analysis, Weight Analysis, Tool Design, Tooling, Static Testing, Complete Production including Acrylics Forming and Metal Work.

Write for new book illustrating Kawneer's integrated "package" program

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AIRCRAFT PRODUCTS DIVISION

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B-52 Ancillaries Use Pneumatics

Boeing's B-52 Stratofortress is America's first aircraft to have all jet compressor accessory systems driven by air.

The pneumatic power, bled from the second-stage, high-pressure compressor of each of the plane's eight J57 turbojet engines, provides drive energy for the a.c. and d.c. electrical systems, hydraulic and air conditioning systems and the water injection pumps. The air is supplied to power packs located throughout the ship, where it is converted to other forms of energy.

Boeing studies showed that a low-pressure pneumatic system for powering the accessories would be lighter than high-pressure pneumatics, hydraulics or an electrical system.

The final layout consists of a dual system in which air from the four inboard and four outboard engines is piped through separate ducts. Thin stainless steel ducts manifold air from each pair of podded powerplants and pipe it up the strut supporting each pod. Inboard-engine air is ducted along the leading edge of the wing to the fuselage; outboard-engine along the trailing edge.

Leading and trailing edge manifolds are interconnected by ducts which include normally closed shut-off valves. Purpose of the connecting ducts presumably is to allow one system to feed the other in case of power loss or rupture.

Design criteria for the system were based on bleed air temperature up to 750F and pressure to 205 psig.

In production B-52s, bellows are used to absorb thermal expansion, duct misalignment and structural deflection in the wings, struts and nacelles. In the fuselage, these factors are taken care of by expansion loops, omega bends and by the inherent flexibility of the duct configuration.

Duct diameters range from 2.5 in. to 5 in., with wall gages from .016 to .078 in. Piping is insulated with a 0.5-in. layer of Fiberglas covered with Neoprene-impregnated Fiberglas cloth.

In initial tests on the XB-52, expansion bellows in the wing trailing edges became unstable and failed by squirming after exposure to air at 200 psig. for 10 minutes.

Steps taken to correct this included redesign of stability brackets supporting the ducts and their relocation within 2 in. of the expansion bellows flanges. Also, the ducting material (AISI 321) was work-hardened to a strength approximately equivalent to one-quarter hard.

Another problem was bellows cracking, originally thought to result from improper fabricating techniques. These were changed, but cracks still appeared. Tests showed that the new failures were caused by the high weight flow of very hot, high velocity air which produced destructive vibration frequencies.

Solution was to insert a suitable liner in the bellows to smooth the flow and reduce the vibration.

Two types of duct joints are used in the production B-52 pneumatic system—a 40-deg. V-band coupling and a bolted flange.

The V-band coupling, which can be taken apart quickly, incorporates solid steel flanges with aluminum-sheathed millboard gaskets. It is used in only a few locations, where the quick-disconnect feature is required or lack of clearance makes it impossible to use the bolted flange.

The bolted flange joint at first incorporated an aluminum-covered asbestos millboard gasket, similar to the one in the V-band coupling. But a testing program suggested improvements for the production aircraft, including a new gasket material for a better seal, increased flange thickness and radius of fillet between flange and base for added rigidity.

Incomparable
1952
Isabelle Wilson
Good Night, Ladies!
Horror of horrors: After four luscious long-stemmed years, we're seriously thinking of cooking up a new ad campaign without — yes, we said WITHOUT GIRLS! After re-checking the dolls shown here, selected from each of our four femme flings, we think we may be flippin' our corporate lid.
Admitting such a possibility, we make you this sporting proposition: If you'll swear on a stack of old eyebrow pencils to read the written stuff in our upcoming series, and to look at the other photos, we may consider keeping a pint-sized lassie around each month just for Auld Lang Syne. Please write or wire your pleasure immediately.
Model PERFORMANCE!
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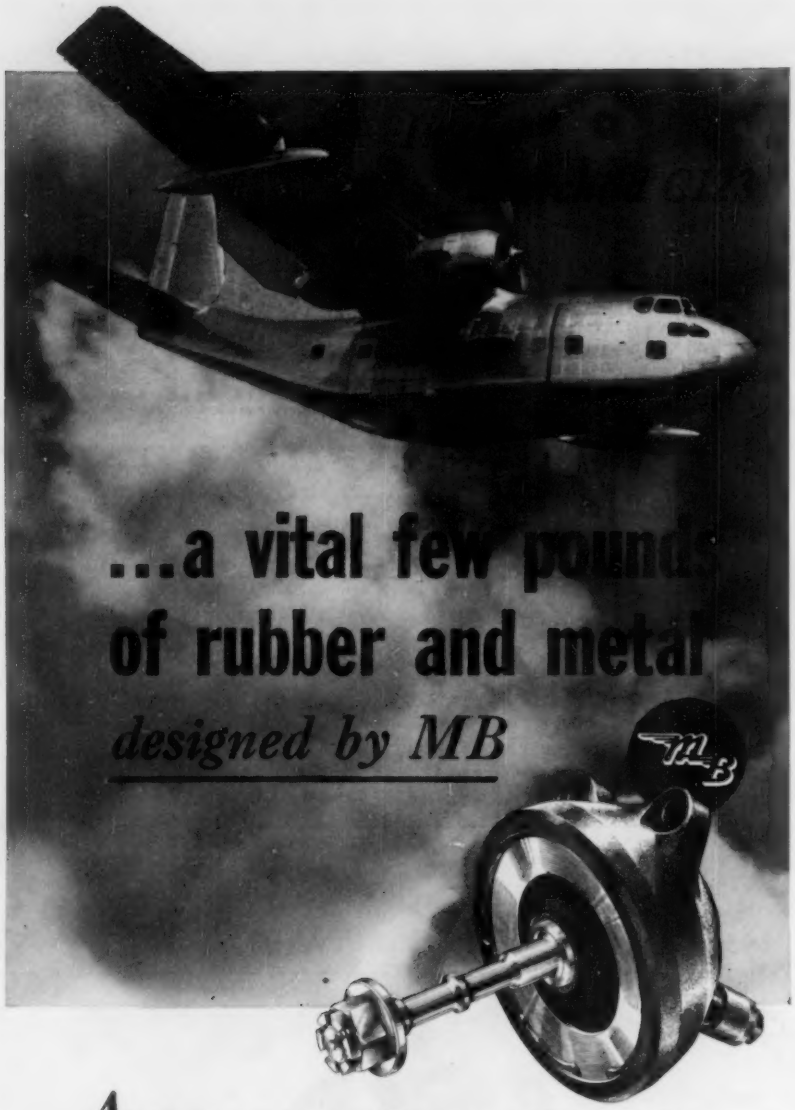

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Many other planes are made bearable for their crews, instruments, and structure by specially-designed MB power plant mounts. You'll find the leading producers of the industry among the other manufacturers who have drawn on MB's 15-year-old fund of busy experience in vibration isolation, measurement and excitation.

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Telling the Market

Beryllium Product Directory describes line of beryllium copper, aluminum and nickel alloys, as well as wrought, forged and cast beryllium copper alloys and copper safety tools, catalog, Beryllium Corp., Reading, Pa. . . . **Selection of abrasive disks** and cylinder wheels, types and sizes, Catalog AC-55, Gardner Machine Co., Beloit, Wis. . . . **Polyvinyl chloride plastic pipe,** Bulletin 24, National Tube Div., U. S. Steel Corp., 525 William Penn Place, Pittsburgh 30, Pa. . . . Facilities for **compression molding,** inspection and finishing, bulletin, Specialty Insulation Manufacturing Co., Inc., Hoosick Falls, N. Y.

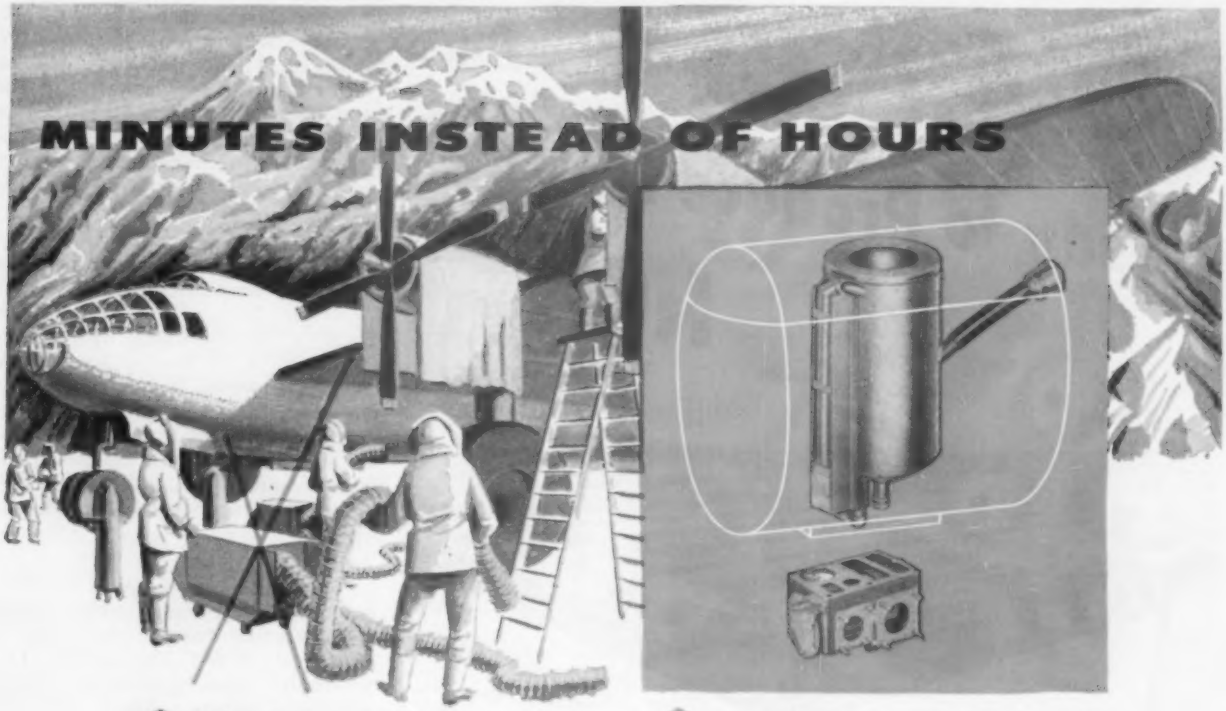
Leak-proof quick-seal hose couplings, catalog, Titeflex, Inc., 10 Hendee St., Springfield 4, Mass. . . . Miniature ultra-low-torque **precision selector switch,** bulletin, Electro Tec Corp., S. Hackensack, N. J. . . . Light-water and oil moderated **nuclear test reactor,** Bulletin GER-1123; four **nuclear research reactors** and their uses, Bulletin GEA-6326A, General Electric Apparatus Sales Div., Schenectady 5, N. Y. . . . Technical data and circuit design points for **Thru-Con printed wiring boards,** brochure, Electronic Components Dept., General Electric Co., W. Genesee St., Auburn, N. Y.

KeyLift hydraulic cargo lift, bulletin, Keystone Engineering Co., 1445 S. San Pedro St., Los Angeles 15, Calif. . . . Improved method for **finish-machining holes** from the solid, Bulletin 31154, Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. . . . **Heavy duty straddle truck** of 4,000-lb. capacity, Bulletin 831, Raymond Corp., 102-137 Madison St., Greene, N. Y.

DBL-2-EZ **Free Machining High Speed Steel,** Blue Data Sheet, Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa. . . . Twelve **strap clamp assemblies,** folder, Jergens Tool Specialty Co., 712 E. 163 St., Cleveland, Ohio. . . . **Hydraulic Valves for Aircraft,** Industrial and Mobile Applications, Bulletin 101, Electrol Inc., Kingston, N. Y.

Design and Selection of Thermocouples, Bulletin 1601; **Liquid Temperature Thermocouples,** Bulletin 1602; **Gas Temperature Thermocouples,** Bulletin 1603; **Surface Temperature Thermocouples,** Bulletin 1604; Revere Corporation of America, Wallingford, Conn.

High, medium and low pressure **hose**



Engine heat-up time—external ground equipment—6 hours

Engine heat-up time—UAP cold weather oil system—30 minutes

Balance out the continuing use-cost of ground heating facilities with its attendant consumption of time and manpower against the one-time cost of the UAP COLD WEATHER OIL SYSTEM installation.

The UAP COLD WEATHER OIL SYSTEM is designed to furnish *fluid* engine oil after cold-soak at –65°F. without the application of external heat. This initial oil supply is then utilized after engine heat-up to thaw out the make-up oil in the tank outside of the hopper. Oxidation of the oil (sludging) is minimized by the system's deaerating features.

The system is for retrofit on most of the dry sump engines in use at the present time and is in every day service on more than 300 single and multi-engined planes.

Used in conjunction with UAP COLD WEATHER OIL SYSTEMS at temperatures lower than –30°F. is the UAP HOT FUEL PRIME SYSTEM which insures safe, reliable engine starts in 3 minutes or less. Both systems remain installed but inoperative during warm weather flying.

For prompt quotes on UAP COLD WEATHER OIL SYSTEMS cost and delivery factors on existing designs, please send detailed dimensional drawings of your oil tank to UAP Engineering, Dayton, Ohio. For descriptive literature covering both systems please contact any of the UAP Contractual Engineering offices listed.

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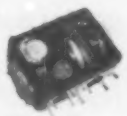
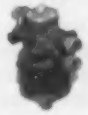

Diverter Segregator Valves

Cold Weather System Hoppers

Oil Tanks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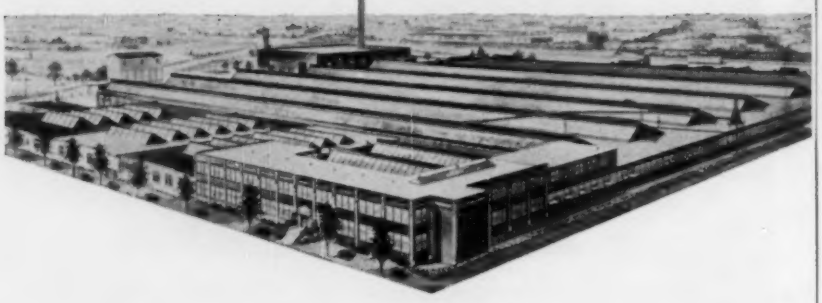

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assemblies for hydraulic, suction return and general applications, Catalog 200, Anchor Coupling Co., Inc., 342 N. Fourth St., Libertyville, Ill. . . . **Micro-Height Gage** for measuring layout and inspection work, Bulletin 105-10, Greist Manufacturing Co., New Haven 15, Conn. . . . **Precision optics,** bulletin, Zenith Optical Laboratory, Copiague, L. I., N. Y.

VU and DB self-contained **precision panel instruments,** Bulletin VU133, Electronic Sales Div., DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y. . . . **Agastat time delay relay models,** Bulletin SD-1, AGA Div., Elastic Stop Nut Corp. of America, Elizabeth, N. J. . . . Series 100 motors, **totally enclosed fan-cooled and open drip-proof types,** Bulletin N-100-R, Howell Electric Motors Co., Howell, Mich.

Automation engineering bulletin describes **positioning control system,** CDC Control Services, Inc., 400 S. Warminster Road, Hatboro, Pa. . . . **Scotchply** brand reinforced plastic, reference manual, Dept. SP5-295, Minnesota Mining & Mfg. Co., St. Paul, Minn. . . . **Alphabetical Tabulator** for translating punched-card data into printed form, Folder TM-933, Remington Rand Div., Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

Tool Pointers

Case studies designed to show how Gisholt tools speed aircraft parts fabrication are given in the company's new 126-page catalog, "Production Pointers." Among the tools described:

- Type 3L saddle type turret lathe and 2F Fastermatic automatic lathe for the jet engine program.
- Four 4F Fastermatic automatic turret lathes for machining jet engine compressor disks.
- Simplimatic automatic lathes for jet engine parts.
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Company's address: Gisholt Machine Co., Madison 10, Wis.

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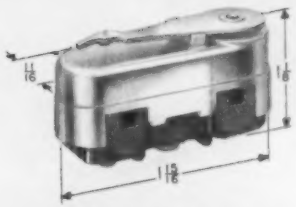
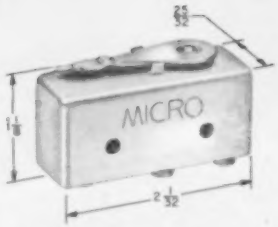


HERMETICALLY SEALED BASIC SWITCH

ENVIRONMENT-PROOF SPLIT CONTACT SWITCH



These environment-proof precision switches are solving many exacting aircraft design problems

● MICRO SWITCH not only offers the most complete line of precise, dependable switches for aircraft applications, but gives a wide choice of hermetically sealed and environment-proof switches.

These MICRO SWITCH units vary in size, housings, mountings and other characteristics to provide aircraft designers with just the right switch for critical requirements.

Shown on this page are just a few of the precision switches developed by MICRO SWITCH engineering to meet specific aircraft design requirements. Whatever your switch need, it will pay you to consult with MICRO SWITCH engineering. For two decades the name "MICRO SWITCH, Freeport, Illinois" has been recognized as the stamp of precision switch quality

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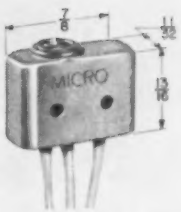
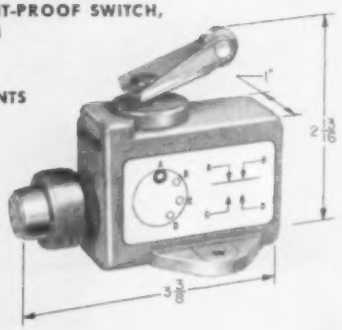
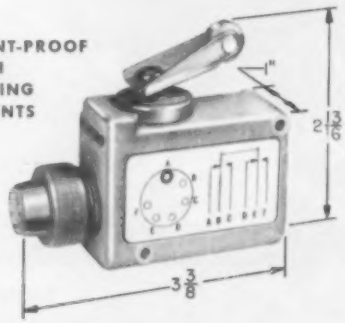


ENVIRONMENT-PROOF SUBMINIATURE SWITCH

ENVIRONMENT-PROOF SWITCH, AVAILABLE IN A VARIETY OF CIRCUIT ARRANGEMENTS



ENVIRONMENT-PROOF SWITCH WITH SIDE MOUNTING ARRANGEMENTS



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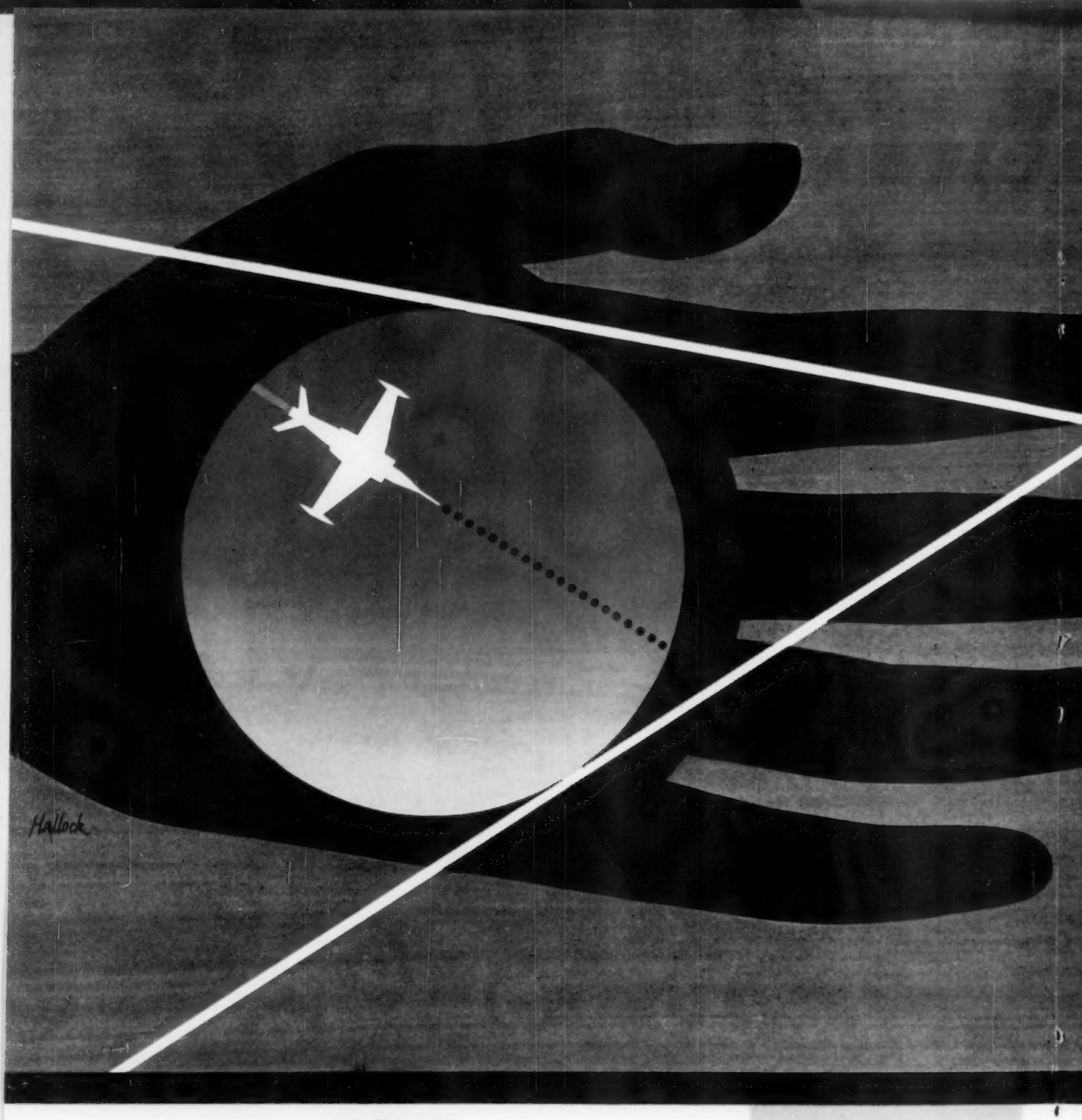

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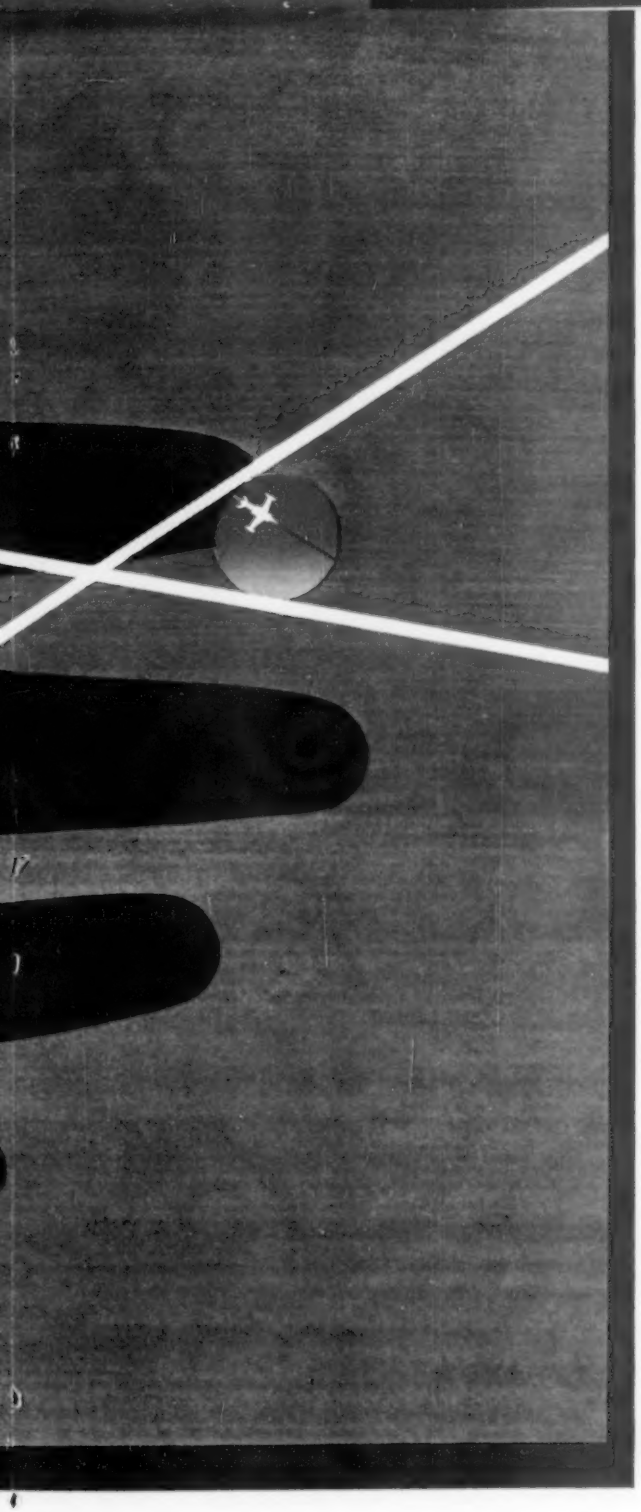

From Crosley— new dimensions for the electronic age

As electronics works its magic for defense and industry, scientists of Avco's Crosley Division reckon with the problem of making already reliable electronic systems more flexible—to give them greater usefulness in navigation, communication, national defense. Now, out of intensive study of electronics and related areas—thermodynamics, optics, aerodynamics, human factors—has emerged the knowledge necessary to achieve this critical goal. Working closely with the military, outstanding Crosley scientists have changed the dimensions of many electronic systems: lightening them, compressing them, "miniaturizing" them. Now—improved radar, communications receivers, navigational aids, and scores of other systems are coming off the Crosley lines and performing their miracles in smaller space, with less weight, requiring less power. Through "miniaturization" in electronics, as well as advances in air-frame assemblies, Crosley brings the findings of research to practical fulfillment—for defense, for peace.

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Avco Defense and Industrial Products combine the scientific skills, and production facilities of 3 great divisions: Crosley; Avco Advanced Development; Lycoming—to produce power plants, electronics, air-frame components, precision parts at: Boston; Cincinnati; Dayton; Everett, Mass.; Los Angeles; Nashville, Tenn.; Stratford, Conn.; Washington, D. C.; Williamsport, Pa.

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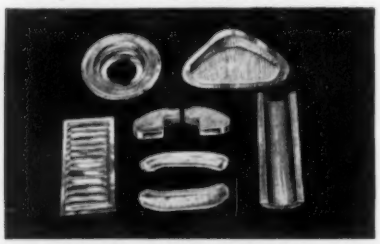
Rockets blast in a flash of fire from the U. S. Air Force's Northrop Scorpion F-89D during armament tests over the Southern California desert.

Thermoflex Thermal Insulation Blanket being applied to a jet engine exhaust cone. Special grooving assures precision fit around cylindrical and conical surfaces . . . allows for expansion at high temperature.



Typical preformed shapes of Thermoflex, custom-made to insulate the intricate and often irregular surfaces involved in many aircraft applications. *Reg. U.S. Pat. Off.

J-M Thermoflex Insulation *controls searing heat of twin jets*

The new F-89D Scorpion . . . rocket-blasting, twin-jet, all-weather interceptor manufactured for the Air Force by Northrop Aircraft, Inc. . . . is equipped with Thermoflex* High Temperature Thermal Insulation Blankets for aft-frame protection.

Thermoflex insulates the shaft housing of the F-89D's jet engine against searing heat . . . helps keep oil and bearing temperatures down to a safe level.

Thermoflex Blankets, standard protection on many Air Force and Navy jets, are custom-made. The insulation filler is made from highly stable Thermoflex RF Felt. This newly developed refractory fiber felt insulation is sealed between sheets of corrosion-resistant metal foils.

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For the complete story of Thermoflex Insulation for aircraft power plants and airframes, send for illustrated folder IN-136A. Address Johns-Manville, Box 60, New York 16, N.Y. In Canada, 199 Bay St., Toronto 1, Ont.

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Lack of Channels May Block Use of Tacan as Common System

By Philip J. Klass

Washington—Serious doubts as to Tacan's ability to provide sufficient channels to meet Common System needs during the 1965 period were voiced by the Air Transport Association in a recent operational memo to its members.

It was the ATA which cast the deciding vote in favor of Tacan earlier this year during the balloting of the seven-man Vortac committee.

Similar uncertainty about Tacan's ability to meet Common System needs exists in other informed quarters, including the Air Navigation Development Board, AVIATION WEEK learned.

ATA's memo estimates that at least 125 channels are needed but that only 90 of Tacan's potential 126 channels can be used because of a conflict with military and civil radar transponders which operate in the same band.

Unless civil DME is scrapped, ATA believes there will be only 60 Tacan channels available.

If ATA is correct, the present VOR-DME system also lacks sufficient channels for the future. Civil DME has 100 channels, while there are 80 channels of VOR and localizer.

The obvious difference between the two situations is that VOR-DME is in existence, whereas Tacan is being considered for future needs.

'Fluid and Confused'

The current domestic airline rush to buy jetliners and the prospect of their operation by late 1959 may also boost DME's stock, unless Tacan is able to win a clearcut victory in the near future.

However, despite nearly two year's efforts to resolve the Common System status of Tacan and DME, the situation at the moment can best be described as "fluid and confused."

For example, a new experimental airborne Tacan set, reportedly capable of automatically transmitting aircraft bearing and distance back to the ground (where it is automatically compared with bearing-distance obtained from ground radar to provide positive aircraft identification) will undergo tests soon.

This feature, which has important uses for both military and civil operations, would give Tacan an operational feature not now available from VOR-DME, and might strengthen Tacan's position.

Several months ago, the Air Navigation Development Board's Advisory Committee No. 3, consisting of representatives of nine different military and civil agencies and airspace users, drew up a plan for future Common System requirements.

It calls for:

- **Airways type coverage** between major traffic hubs, at altitudes of 700 to 18,000 feet.
- **Another set of airways** at altitudes of 18,000 to 75,000 ft.
- **Area (grid) type coverage** at altitudes of 18,000 to 75,000 ft. This would permit off-airways flight when aircraft are equipped with off-course computers.

Which Plan?

Some of the confusion stems from the fact that the ANDB committee tacked on three alternate plans to its recommendation, without clearly indicating whether these are acceptable if the first of the proposed plans can not be achieved.

A National Bureau of Standards determination of the number of Tacan channels required to implement each of the four different plans, originally scheduled for completion this month, has been delayed until early 1956. If this analysis indicates that Tacan lacks sufficient channels to meet the first plan, but is able to meet one or more of the others, observers expect another hassle to break out.

On the surface, the recent two-day Tacan symposium here, sponsored by the ANDB, might have led some to believe that adoption of Tacan as a Common System navigation aid was a foregone conclusion, although this was not ANDB's intention. The symposium was attended by 700 people, with interested observers from more than 20 foreign governments, including the Soviet Union.

(The USSR embassy representative, Engineer Major Vladimir V. Kolentsev, assistant air attache, told AVIATION WEEK that he was impressed with Tacan's capabilities, but added that he is neither an electronics engineer nor a navigation aids expert.)

During the detailed reports on the technical and operational characteristics of Tacan airborne and ground equipment there was only an occasional reference to the bitter controversy going on behind the scenes. A report by the Civil Aeronautics Administration on its evaluation of early model Tacan equipments showed bearing errors of as much as 2½ to 3 degrees considerably higher than those reported by Navy, Air Force and Airborne Instruments Lab representatives, some of whose tests were run on improved later models. These latter tests indicated bearing errors of less than one degree.

Behind the Scenes

Behind the apparent calm of the symposium, however, in little impromptu gatherings in the corridors, the air was filled with rumors. One observer was overheard to remark that the symposium might prove to be "a wake for Tacan."

The question of whether Tacan offers sufficient channels is deceptively simple.

On the surface, Tacan appears to have 126 channels. However, not all of these channels are available for use, because military and civil transponder (radar) beacons are interrogated at 1,030 mc. and reply on 1,090 mc., right in the middle of the Tacan band.

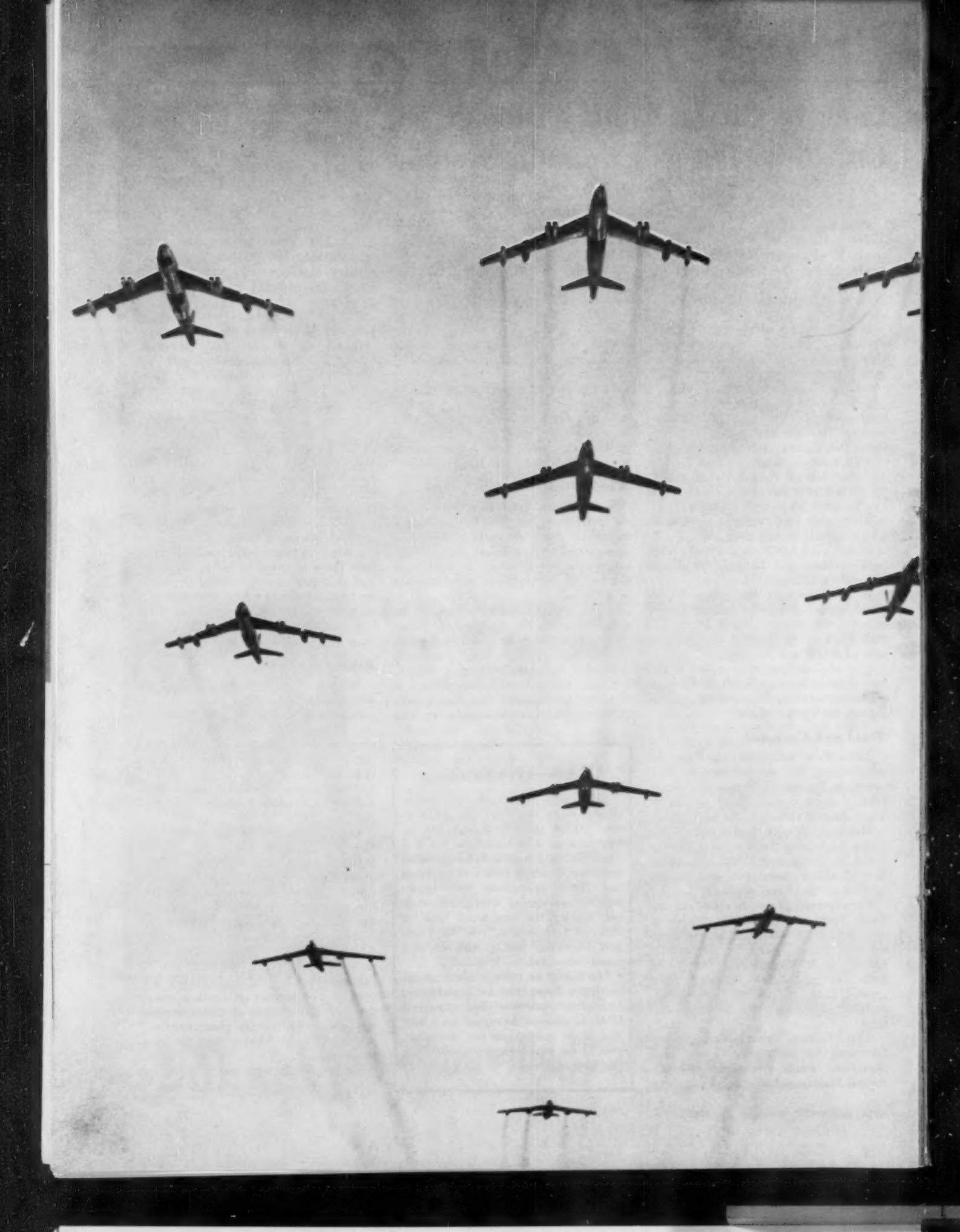
Airborne Instruments Lab, under ANDB sponsorship, has made a study of how many Tacan channels will be incapacitated by the transponder beacons. The answer is "not a single number, but a range of values depending upon the beacon characteristics," ANDB's D. K. Martin told the symposium.

Informed observers say that, in any case, the beacon will knock down the

ATA Sees No Solution

"The effort to provide one system (either Tacan or DME) has failed to date. What the Government will do from now on is problematical, but it is a fact that there is no known engineering technique by which both existing Tacan and DME equipments, fully implemented, can operate satisfactorily without limiting the operational value of either or both systems," the Air Transport Association told its members in a recent memorandum. It added:

"In failing to make a clean-cut decision for Tacan, the Air Coordinating Committee probably has permitted DME to continue to expand on a basis that, in our opinion, can not be stopped, even by the 1960 'tongue-in-cheek' deadline now established."



NOW IT'S 8,500,000 HOURS FOR THE G-E J47 IN THE AIR

As General Electric enters its 15th year in jet design and manufacture, J47 sets new world record for jet operational flight time

Just where the 8,500,000-hour mark was set this month, is not known. It could have been in the Boeing B-47's shown on the left. Or in the trim North American F-86D shown below.

The significant fact is that the J47's new record represents a jet milestone. For now this single General Electric jet engine has more hours in the air than any other known jet engine in the world.

Despite J47 operating and durability records, General Electric's ultimate jet goal remains, "Faster . . . farther . . . higher." To translate this objective into hardware, G-E technicians are today concentrating on the development of still better, more reliable engines for future aircraft. For example:

- **A greatly advanced G-E jet** engine is now being tested. When it goes into production, it will make possible forward strides in the speed and performance of new fighters and bombers.
- **Still more advanced G-E powerplants**—including rocket and atomic—are in early development phases. And General Electric is backing its development programs with a multi-million investment in new facilities, studies in advanced propulsion principles, and the development of new components and accessories.

Since initial delivery to the Air Force in 1948, J47's have flown more than 4½ billion miles—the equivalent of 50 trips to the sun. This mark may not be surpassed, except by the J47 itself, for some time to come. Today, more G-E jet engines power Air Force planes than all other jet engines combined. 232-9

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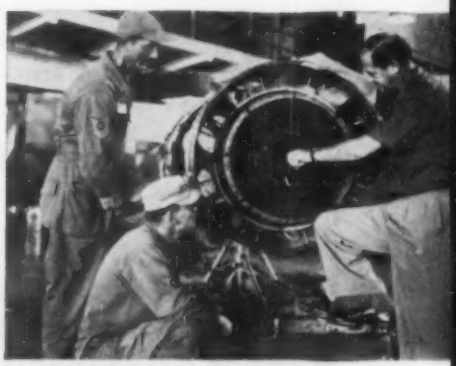
"IN COMMISSION" RATE of J47-powered aircraft is now at record high. Each day, over 12,000 J47's are installed, ready to go in USAF fighters and bombers. North American F-86D, above, is powered by J47-GE-33.

HIGH RELIABILITY of G-E J47's is especially evident in engines now installed in Boeing B-47's. 1200 hours allowable-time-to-overhaul on some models of B-47 engines has helped cut costs, increase Strategic Air Command combat punch.



IMPROVED MAINTENANCE of J47's in recent years has paid off in better G-E jet performance for U. S. Air Force. Joint effort of G-E tech reps and USAF training personnel is playing vital role.

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number of usable Tacan channels to around 100, roughly equal to the number of DME channels and slightly more than VOR.

ATA is more pessimistic, estimating that there will be only 90 Tacan channels available, or only 60 if civil DME is operated.

Co-Channel Interference

The crux of the question over the number of channels required arises from the problem of co-channel interference, i.e. interference between two stations operating at the same frequency within range of one another.

From limited tests which Federal Telecommunications Laboratory has run, it appears that two Tacan stations can be operated at the same frequency within line-of-sight range of one another, without the serious interferenee which would be encountered with continuous-wave (CW) systems such as VOR.

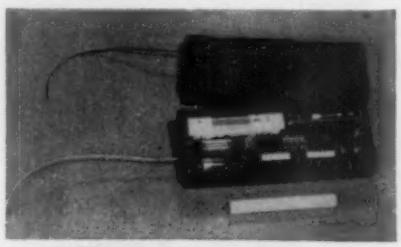
Whether co-channel Tacan stations can be spaced more closely than VOR stations will depend upon whether current tests confirm the preliminary Federal's findings.

Countering this possible Tacan advantage, however, is the effect of "nulls" or lobes in Tacan's vertical coverage. This condition, which results from ground-reflected signals canceling out the direct-path signals, is much more critical at 1,000 mc. than at the lower VOR frequencies.

Altitude Controls Spacing

Another factor which determines co-channel station spacing is the maximum altitude at which navigation signals must be usable and above which some interference or loss of signal may be tolerated.

For example, if the top limit on the low-altitude Tacan airways network were 18,000 feet (as in ANDB's Plan No. 1), stations operating at the same frequency must be separated by approximately 450 miles. If this altitude figure were dropped to 10,000 feet (per



Midget Receiver

Midget radio receiver, pre-tuned to either 35.58 or 43.58 mc., and weighing only 6 oz., including built-in batteries, is suitable for paging service. Manufacturer: West Coast Electronics Co., 5873 West Jefferson Blvd., Los Angeles, Calif.

ANDB Plan No. 3), co-channel stations could be located within approximately 320 miles of each other.

From the following tabulation of the four plans proposed by ANDB's Advisory Committee No. 3, it can be seen that the particular plan adopted for Tacan coverage will have a major effect on the number of Tacan channels required:

Plan No.	Airways Coverage	Grid Coverage
1	700-18,000 ft.; plus another airway 18,000-75,000 ft.	18,000-75,000 ft.
2	700-18,000 ft.	18,000-75,000 ft.
3	700-10,000 ft.	10,000-75,000 ft.
4	None	1,000-75,000 ft.

DME Head Start

Distance information, a useful addition to any cockpit, takes on special importance in a jetliner, whose ravenous fuel appetite does not permit much low-altitude loitering during an approach. CAA has set up procedures which permit a DME-equipped airliner to make a fast straight-in approach and landing, instead of requiring the usual pattern approach.

While CAA would have to extend similar privileges to Tacan-equipped airliners if Tacan should become the Common System, the fact that civil DME has at least several years jump on Tacan from an implementation standpoint works to its advantage.

CAA now has 378 DME ground stations installed, of which 234 are now in operation. The military, on the other hand, has taken delivery on a total of 300 URN-3 Tacan ground stations, but only 50 of these are installed, and only a handful of this number are operating in the U. S.

Although official figures are not available, it is safe to estimate that it will take a minimum of two to three years before the number of military Tacan stations in the U. S. equals the number of DMEs. And even then, the military Tacan stations will not provide the complete civil airways coverage required.

CAA reportedly estimates that it will take three to four years merely to redesign the military Tacan ground station equipment to make it suitable for civil use. (This involves redesign for dual equipment, with automatic switchover, plus conversion from single to three-phase a.c. power.)

Unless CAA is able to speed up this cycle, it would certainly take another five years for industry to build the equipment and for CAA to install and commission it.

Airline Position

The airlines understandably are reluctant to become embroiled in the merits of Tacan versus DME. However, officials of two airlines which

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Breaking the Sound Barrier

TEMCO helps build the supersonic **F-100** Super Sabre

Recently, North American awarded TEMCO three important jobs on the Air Force F-100 Super Sabre.

This fighter was the first operational aircraft to break the sound barrier in level flight. Vital F-100 components — wing-tip panels, ailerons, flaps, pylons — are being fabricated at TEMCO.

These jobs are typical of TEMCO's work on a growing number of first-line military aircraft. And, on its 10th Anniversary, TEMCO pledges a continuing effort to preserve the peace by keeping America strong — **the industry's Number One Job.**

ENGINEERS . . . if you are interested in a position with a growing weapons system organization, write full particulars to E. J. Horton, Jr., Engineering Personnel, TEMCO Aircraft Corporation, P. O. Box 6191, Dallas 2, Texas.

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recently ordered jetliners used almost identical language in describing their operational requirements: "Some type of distance information is highly desirable."

A turboprop airliner is committed to a landing when it gets down to 10,000 ft. altitude, and a turbojet is committed at 20,000 feet, unlike a piston-engine aircraft which can come down for a "look see," and then proceed to an alternate if necessary, one airline official told AVIATION WEEK. "This makes accurate knowledge of distance to destination much more important," he said.

The other airline official said his company expects to install airborne weather radar in its jets, and that this equipment can provide a crude type of distance information in event that Tacan or DME is not installed.

Decision Needed Soon

Within the next few months the airlines will have to specify the avionics equipment which is to go into their new jetliners. Unless a firm ANDB decision is reached before that time, each carrier will have to make its own appraisal of the probable winner. The alternative is to have the airframe manufacturer make only generalized wiring provisions, capable of adaptation to either type of equipment at some later date.

One ATA fear is that some airlines may buy DME, others Tacan, creating a serious division within the ranks of the air carriers.

Aeronautical Radio Inc., which draws up equipment characteristics (specs) to provide overall interchangeability between airborne equipments made by

Small & Powerful

This self-contained magnetron tube for use in small portable radar sets is not only said to be the world's smallest but is 50 times more powerful than the klystron tube it replaces. The new magnetron, weighing only 8 oz., was developed at Army Signal Corps Engineering Laboratories, Ft. Monmouth, N. J.

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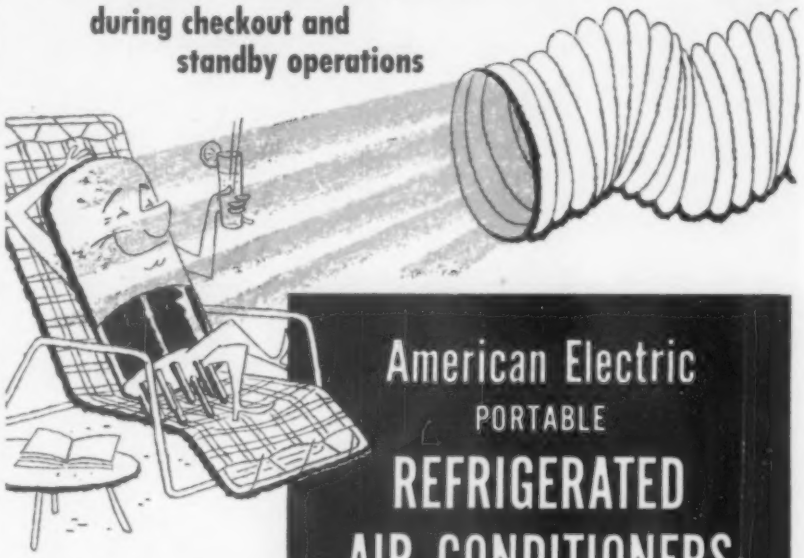

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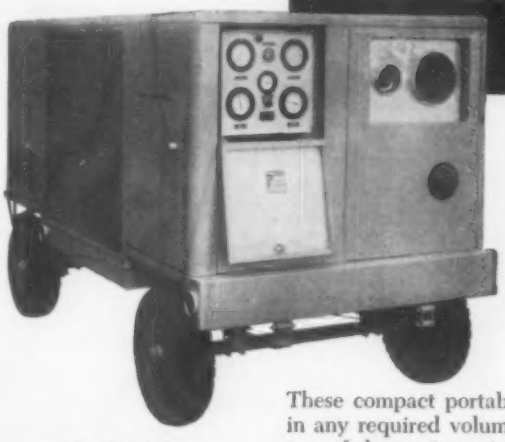

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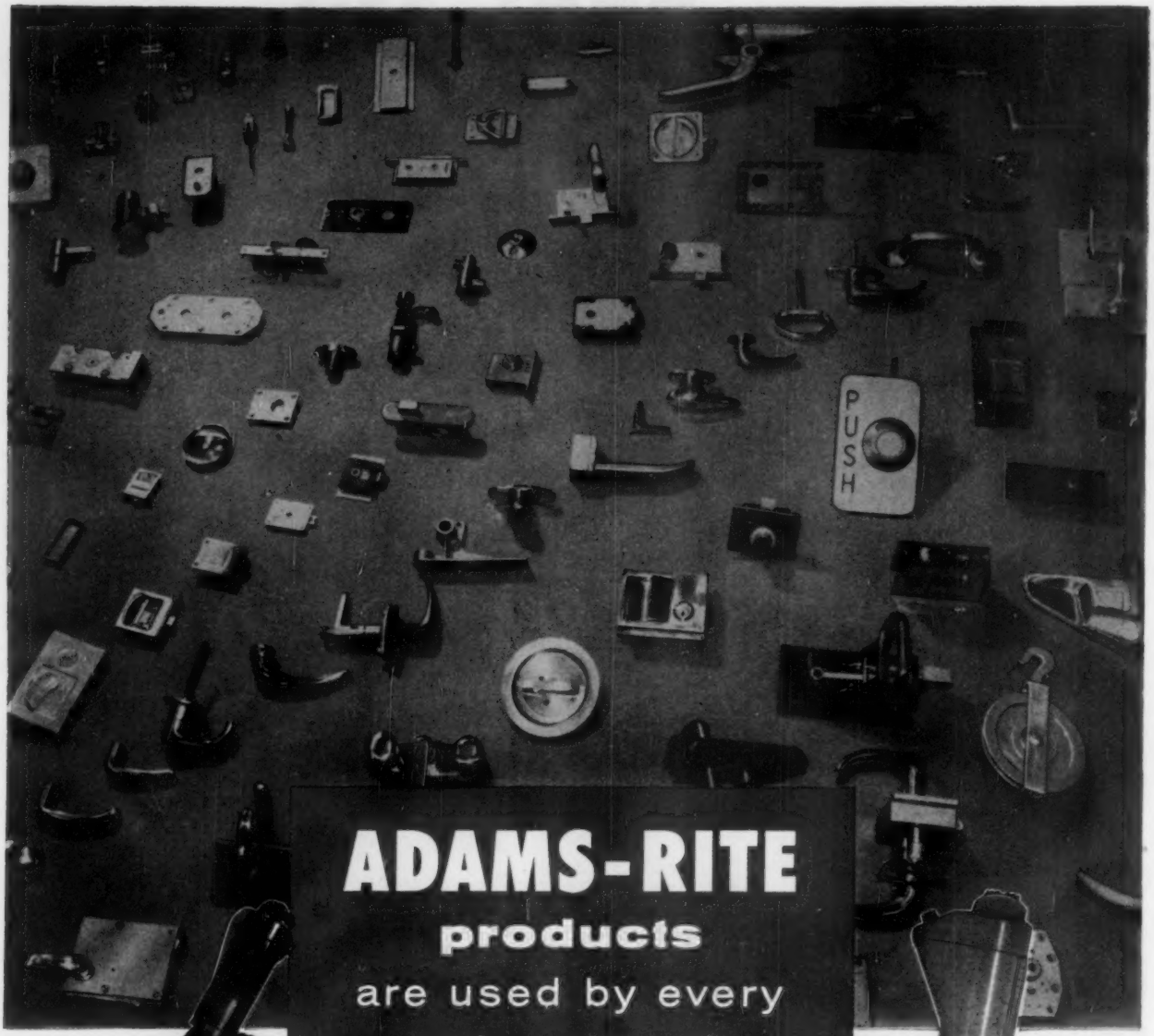

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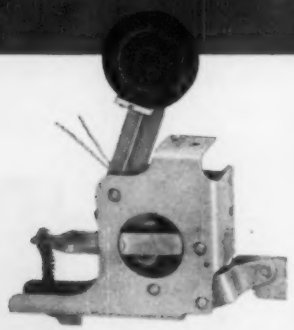

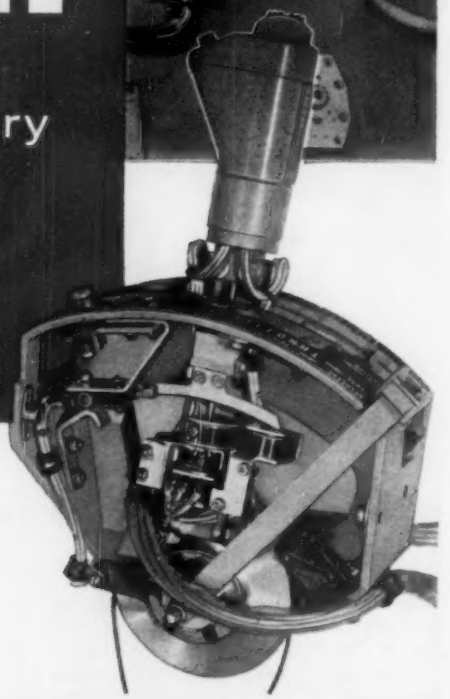

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different manufacturers, has a partially drafted characteristic for DME. Work on the spec was stopped when the Tacan/DME hassle arose.

For this reason, Arinc could come up with a DME spec sooner than one for an airborne Tacan set. Unless the airlines drop their present strong prejudice against the use of subminiature tubes, a major redesign of present military Tacan receivers for airline use appears certain.

Two recently disclosed developments may serve to further muddy the dirty Tacan/VOR-DME waters:

• **New multi-lobe VOR,** reportedly capable of providing improved bearing accuracy comparable to Tacan, has been developed by Standard Radio & Telephone Co., of Britain. Ironically, this firm is an affiliate of International Telephone & Telegraph Co. which developed and is pushing Tacan.

• **Increased civil DME channels** are possible employing techniques being developed by CAA's Technical Development Evaluation Center.

These are some of the factors which lead many observers to doubt whether a clearcut decision will be forthcoming in the near future to firmly resolve the bitter controversy, barring an arbitrary edict from high government sources.

FILTER CENTER

▶ **X-band Radar Orders Grow**—Northwest Airlines will equip its DC-6 fleet with Bendix X-band radar, making it the fourth airline to buy 3.2 cm. weather radar. (Panagra, National and Eastern Air Lines are also in the X-band camp.)

▶ **New Navy HF Transceiver**—Collins Radio has received a Navy contract to produce its new 35,000-channel HF transceiver, the AN/ARC-38. The new unit offers similar capability to USAF's ARC-21. The ARC-38 is an adaptation of the Collins commercial 618S HF transceiver, except that it uses a stabilized master oscillator to eliminate the need for a large bank of crystals.

▶ **It Serves Them Right**—"Anyone who would dignify a stupid electronic computer by calling it a 'brain,' deserves to have one just like it," according to Frank Godsey, general manager of Westinghouse Electric's Air Arm and Electronics Divisions. Godsey got the remark off during the recent East Coast Conference on Aeronautical and Navigational Electronics, where he served as toastmaster.

▶ **New Look for Airline Avionics**—Watch for more and more of the new

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2) *Inertial Guidance*

Engineers and Physicists are wanted for missile inertial guidance component development. Work involves design, development and evaluation of gyros, accelerometers, integrators, stable platform systems and associated apparatus. Particular emphasis is placed on the problem of achieving component performance under severe environmental conditions, and on development of advanced testing techniques.

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4) *Switching Circuits*

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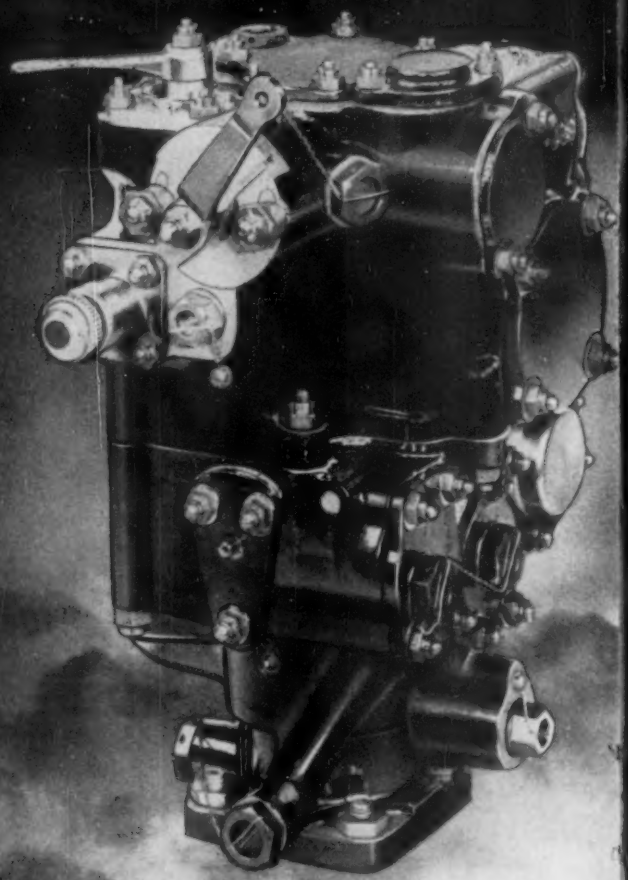
New Hydro-Mechanical Fuel Control by Honeywell



What it looks like. *One configuration of the Honeywell series 40 hydro-mechanical gas turbine engine control is shown above. Capable of being packaged to fit any envelope, it requires only about 120 cubic inches of space, weighs less than 10 pounds.*

For any gas-turbine aircraft—fixed wing or helicopter

EFFICIENT, LIGHT, COMPACT, RELIABLE. These qualities, equipment "musts" for any jet aircraft, are characteristic of the new Honeywell series 40 hydro-mechanical fuel control.

The new unit is designed to control fuel flow automatically on turboprop and turbojet engines. With it, engine control is automatic—yet the pilot can take over in an emergency.

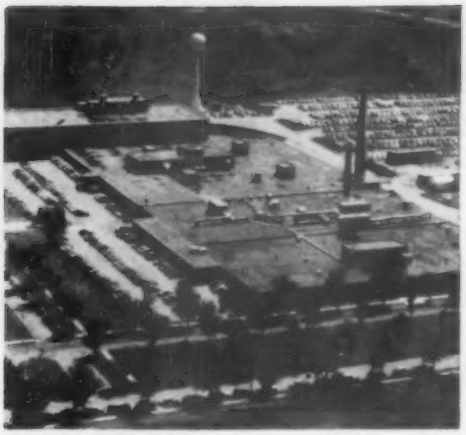
The series 40 is an isochronous governing unit that's ideal for single-spool and twin-spool turbojets, free- and direct-coupled turboprops and ducted fan engines. The fuel itself accomplishes all control functions. No external source of electrical, pneumatic or hydraulic power is needed.

Honeywell's years of experience in designing engine regulator controls are reflected in the design of the new control.

Flexibility an important feature • The series 40 can be sized for fuel flows up to 6,000 pounds per hour. Other series of Honeywell fuel controls utilizing the same principles can be designed for higher fuel flows. • Control components can be packaged to fit any specified envelope. • Control fuel output can be overridden or trimmed by applying additional input signals (examples: temperature trim, temperature override, overspeed.) • The basic control can produce signals such as actual engine speed, corrected engine speed and engine inlet air pressure for use in other engine control loops (examples: compressor bleed control, inlet guide vane control).

High lights • Small and compact in size (120 cubic inches or less possible without emergency feature). • Exceptionally clean design. The control can be mounted on a "sandwich" type fuel pump, thereby eliminating cumbersome plumbing. • Operation at any altitude from sea level to 60,000 feet and up to and including ram ratios of 1.8. • Accommodation of drive speeds within the range of 850-6,000 rpm. • The series 40 control is designed to meet the applicable portions of Specifications MIL-E-5009A and MIL-E-5007A. • Incorporates an emergency manual control (optional).

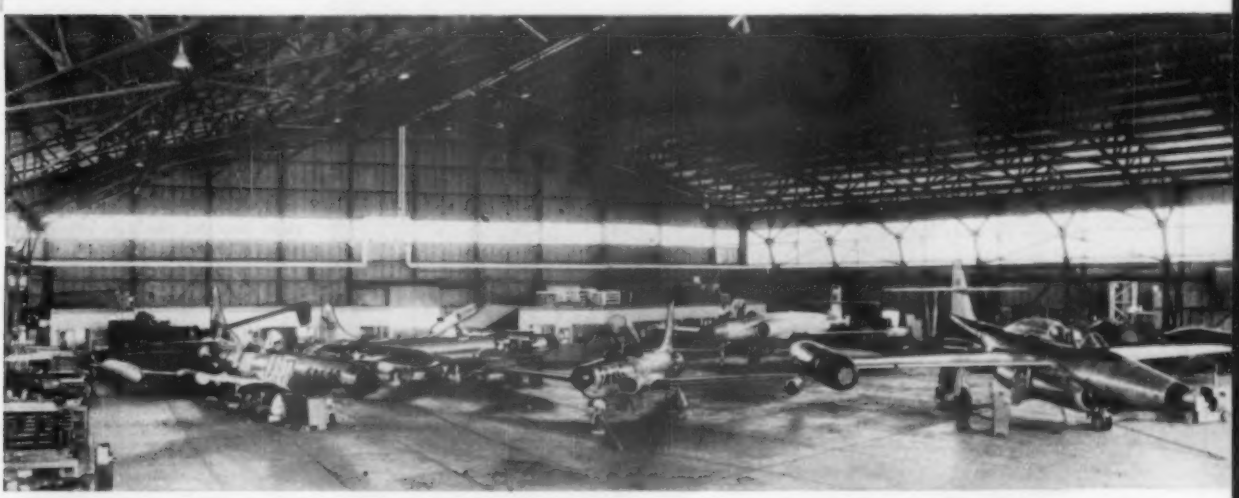
Honeywell jet engine controls are available to manufacturers who require precision performance. For details write on your business letterhead to Dept. AW-11-153, at the address given on the right.



Where it's made. This is an aerial view of the main Aero Division plant in Minneapolis. The entire 12 acres of modern plant is devoted exclusively to the manufacture of air-borne controls. Over 5,000 people work on the varied operations. Hundreds of these work solely on jet engine controls, making Honeywell a leading specialist in the engine control business.

Laboratory tests on the series 40 fuel control were made in this engine control laboratory adjacent to the main Honeywell Aero plant. Computers shown above played an important role in this phase of testing. Every theoretical flight condition was set up on the machines to give the control rigid standards to meet. Only then was the new control ready to be flight tested.

Thorough flight tests are made on all Honeywell aeronautical controls. Base of operation is the Honeywell flight line at Wold-Chamberlin field in Minneapolis. A hangar of ships undergoing tests is shown below in this photo of Honeywell's facilities at the Minneapolis field.



A note to engineers. *Almost daily, exciting new positions open in our instrument and control work. We need qualified men. If you're interested in opportunity, write: Director of Engineering, 2600 Ridgway Road, Minneapolis 13, Minnesota.*

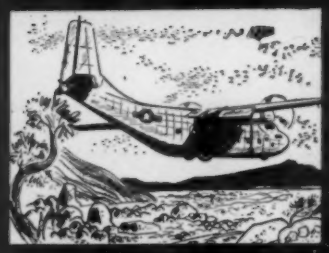
MINNEAPOLIS
Honeywell

Aeronautical Division

H
HONEYWELL

2600 Ridgway Road, Minneapolis 13, Minnesota

BIG LOAD • BIG LIFT
BIG PERFORMANCE
ARE BUILT INTO
FAIRCHILD C-123



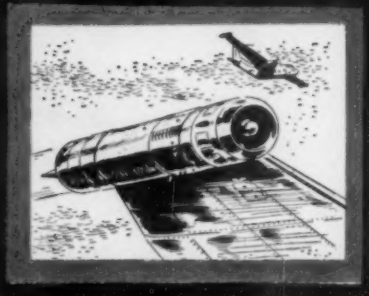
Lands or takes off in less than 10 times its own length. The Fairchild C-123 operates on any terrain with only 600 feet of field space.

Maximum load-carrying capacity and workhorse durability are just two of the many reasons why the Fairchild C-123 Assault Transport is ideally suited to tough jobs in all combat airlift operations.

Equipped with Fairchild J44 turbojets on each wing-tip, the C-123 is provided with a power package of 2,000 lbs. extra thrust to meet any critical take-off or flight requirement.

In front line operations, on any terrain, under the most difficult conditions, the Fairchild C-123 gives *big load, big lift,* and *big performance* where and when utility and logistics support is needed.

A Division of Fairchild Engine and Airplane Corporation.



Fairchild J44 turbojet engines give added power thrust to the C-123, providing an extra margin of safety for any emergency condition.

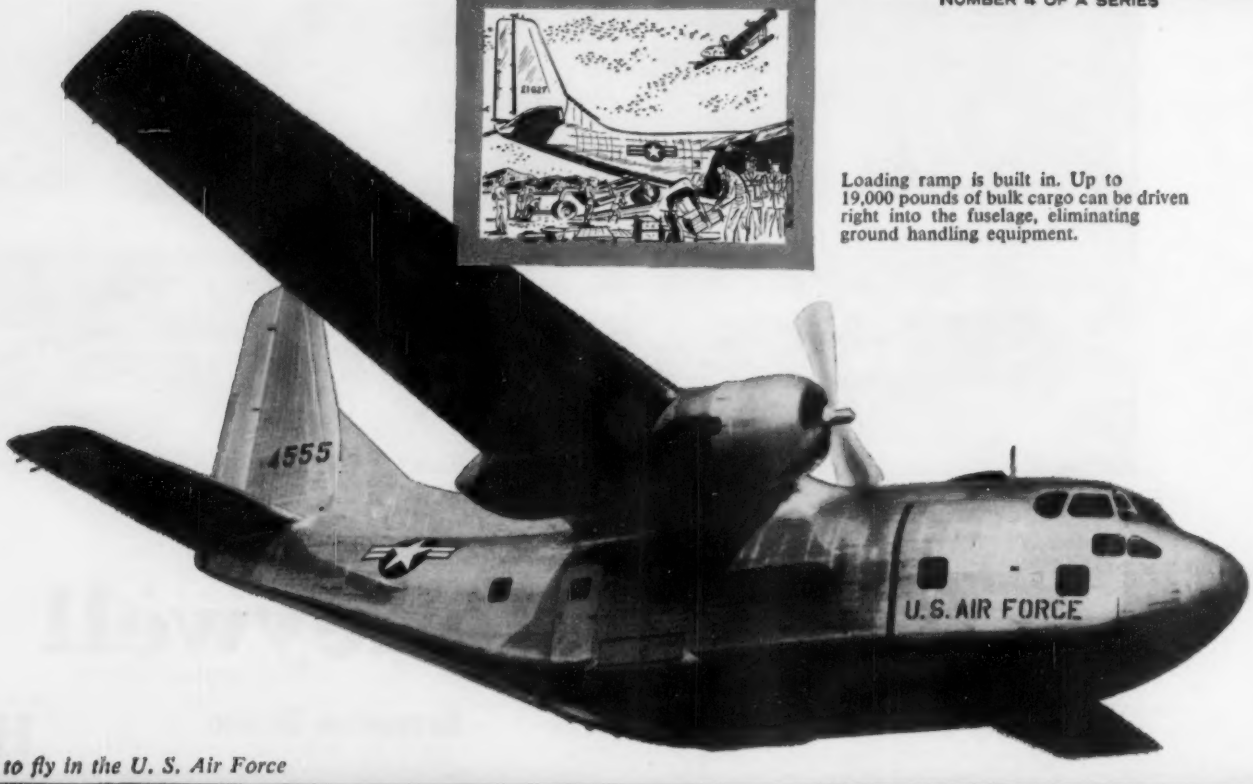
FAIRCHILD

AIRCRAFT DIVISION • HAGERSTOWN, MARYLAND

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

NUMBER 4 OF A SERIES

Loading ramp is built in. Up to 19,000 pounds of bulk cargo can be driven right into the fuselage, eliminating ground handling equipment.



Enlist to fly in the U. S. Air Force

airline avionics equipments to come out in smaller packages, including the new ¼ and ⅜ ATR size cases, reflecting greater use of miniaturization techniques. For example, Collins Radio Co.'s new Selcal (selective calling) amplifier and isolation amplifier each come in ¼ ATRs, while Bendix Radio's new marker receiver, available in January, also comes in a ¼ ATR case. (Pan American has ordered 15 of the new MKA-7 Bendix marker receivers for installation in its DC-7s.)

▶**Ode to Tacan**—Although the battle between Tacan and DME supporters continues unabated, one of the protagonists has mellowed to the point of composing the following "Ballad of Amazing Tacan," to be sung to the tune of "Davy Crockett."

Born on a table top at IT&T
To work on a flat-top on the high seas
Grabbed by the Air Force when it was only "three"
Offered to the world to replace D-M-E

CHORUS: *Tacan, amazing Tacan, the U. S. controversy.*

Works like a charm on a Navy plane
CAA wonders who's to blame
AOPA says it's all in vain
'Cause it won't fit in their members' planes.

CHORUS: *Tacan, amazing Tacan, the navigation aid of fame.*

It needs a lot of frequencies
But it will give sharp accura-cy.
Though nurtured by the brass and the braid, you see,
They forgot to reckon with the A-N-D-B.

CHORUS: *Tacan, amazing Tacan, it works so marvelously.*

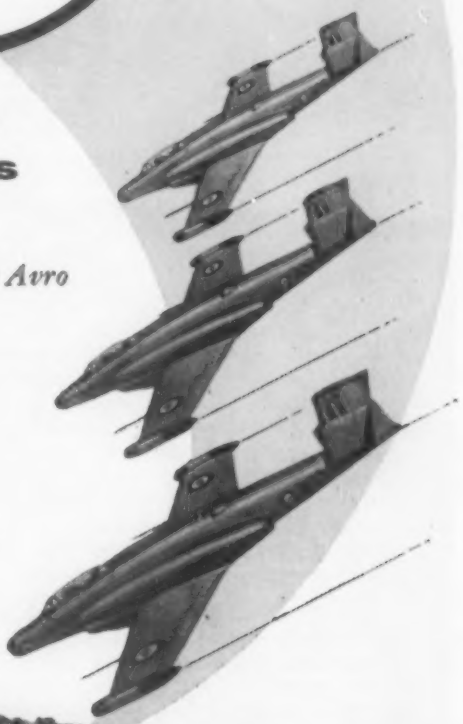
▶**Raytheon to X-Ray Tubes**—Raytheon Manufacturing Co. has completed a facility which will enable it to make X-ray photos of 20 vacuum tubes simultaneously, to detect welding or assembly flaws which can not be spotted by microscopic examination. The Raytheon facility consists of a lead-lined (shielded) room measuring 8x12x15 ft. and a 300,000-volt X-ray machine. Company reports that X-ray inspection already has disclosed tiny flaws in the welding of minute hair-size parts which appeared to be perfect under a high power microscope.

▶**New Radar Techniques**—Hughes Aircraft is developing a new anti-aircraft network which employs array-type antennas and traveling wave tubes, in combination with digital data handling and processing equipment.

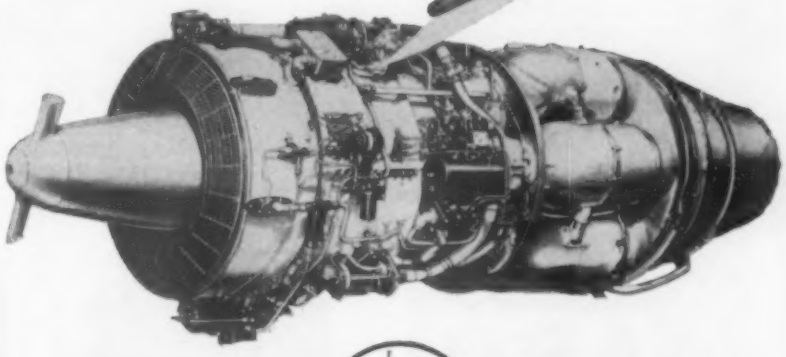
GLA

ignition . . .

on Orenda Jet Engines



. . . power plant for the Avro CF-100, formidable fighter-interceptor on duty with the Royal Canadian Air Force in the defense of Canada and the North American continent.



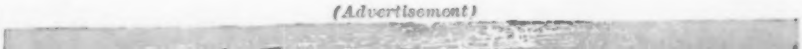
GENERAL LABORATORY ASSOCIATES, INC.
Norwich GLA New York

AIRCRAFT IGNITION AND ELECTRONIC EQUIPMENT

WEST COAST SALES & SERVICE, 3903 Warner Blvd., Burbank, Calif., Victoria 94390

NEW AVIONIC PRODUCTS

(Advertisement)



ARO Flies With The Super Sabre*

Just seconds after the tiny white contrail breaks into the blue, she's here and gone! Out of sight, almost, before the thunder from her jets is heard 40,000 feet below. It's the Air Force North American F-100 Super Sabre streaking into aviation's hall of fame at 822.135 M.P.H.—world's first supersonic speed record. And aboard, to protect pilot Col. H. A. Hanes, U.S.A.F., is precision-built Aro oxygen and "Anti-G" equipment.

Leading aircraft makers and the Military depend on Aro research and development for equipment to meet today's needs—and to be ready for tomorrow's. Nobody knows when Col. Hanes' record will be broken. But it's a safe bet that when it is, Aro equipment will be aboard. For details on how Aro can serve you, write:

...to first supersonic world speed record!

*Trademark Registered by North American Aviation, Inc.

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Aro of California, Los Angeles 7
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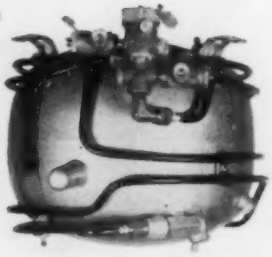
Offices in all principal cities

ARO®

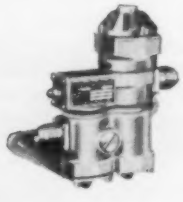
AIRCRAFT PRODUCTS

Liquid Oxygen Converters, Oxygen Regulators, Pressure Regulators, Contents Gauges, Relief Valves, Anti-G Valves, Air and Oxygen System Accessories, Actuating Cylinders and other Aircraft Accessories.



ARO Liquid Oxygen Converter — assures ample oxygen supply with big savings in space and weight. The Super Sabre carries the Aro 5 Liter Converter.

ARO D-2 Oxygen Regulator —another Aro precision instrument aboard the Super Sabre to insure safety of pilots in high-altitude flight.

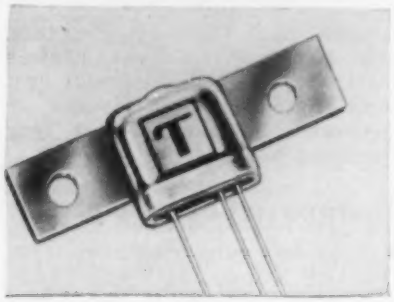


ARO "Anti-G" Valves—afford protection to Super Sabre pilots against the physical strain of extreme centrifugal force.

NEW AVIONIC PRODUCTS

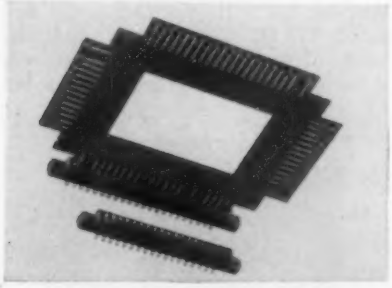
Components & Devices

● **Medium-power transistors,** germanium Types 2N85, 86 and 87, are intended for Class A or B output or driving stages. A pair of 2N86 transistors, operated push-pull Class B, can



deliver 1.5 watts output at temperatures up to 70C when mounted on an aluminum chassis which serves as a heat sink. Units are hermetically sealed under vacuum. Transitron Electronic Corp., Melrose 76, Mass.

● **Printed circuit connectors,** Series P-C, employ novel bellows-type construction which enables them to function satisfactorily despite a 0.054 to 0.071 in. variation in the thickness of a $\frac{1}{16}$ in. copper-clad printed circuit



board. Special connectors accommodate a $\frac{1}{8}$ in. board. Connectors are available in single or double row construction, with 6, 10, 15, 18 or 22 contacts. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

● **Miniature vacuum fixed capacitors,** Type JCSF, called smallest on the market by their maker, measure only $1\frac{3}{8}$ in. dia x $1\frac{3}{8}$ in. long. Units are available with capacities of 25, 40, 80, 120 and 150 $\mu\mu$fd., at voltages of $7\frac{1}{2}$, 10, and 15 kv. peak. Unit's small size, low inductance and negligible dissipation factor make it useful at higher frequencies. Jennings Radio Mfg. Corp., P.O. Box 1278, San Jose, Calif.

● **Vacuum tube shock mount,** Model K271, for vibration isolation of individual tubes in critical applications,

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.

It's regrettable that you engineers don't have somewhat the same opportunity to observe the Wm. R. Whittaker Co., Ltd. that is afforded outside accountants in auditing the company's books.

Almost invariably — after they've gone over the records and noted the valve firm's alert progressiveness, its friendly, informal atmosphere and the many benefits accorded employees — they apply for work as Whittaker accountants!

I feel sure if you could see the Whittaker engineering setup in Southern California, and find in one thriving, moderate sized company the opportunity, the salary and the working conditions you've perhaps long sought — you, too, would be filling out an application form.

Why?

Because Whittaker is basically an engineering firm. Its president and founder, Bob Whittaker, is an engineer. Virtually all its top men are engineers. It has what I would call an aura of engineering — of appreciation and understanding for the effort and capabilities of the technical expert.

The best recommendation I can think of are the engineers themselves. Ask any one of the veterans why they have been with the company so long. Or ask any of the younger men why they hope to remain with Whittaker for years to come.

They'll tell you they like Whittaker's project engineering system, which allows a man to follow a given job from proposal to acceptance and final stages of production — and even later, into the field, if necessary.

They'll tell you they like a department with no closed doors; where suggestions, ideas and recommendations are evaluated to the hilt; where the achievements of creative talent win the tributes they deserve; where encouragement is the by-word rather than pattern and routine.

And they'll tell you they appreciate Whittaker's informal atmosphere, so unlike the regimen of the big plants where a man can be lost from sight and his ideas lost with him.

These are the things that count with engineers, even above salary: Encouragement, opportunity, the right environment, and the tools to work with. Whittaker provides these to the fullest extent, plus the more material things, such as salary and benefits.

You'll find Whittaker pays for ability and achievement, certainly as well, perhaps better, than other firms in the industry. Nor are the benefits forgotten.

Take the profit sharing retirement plan, for instance. Each year the company contributes to a trust fund 15% of the total base earnings of each plan participant (the maximum allowed by Treasury Department regulations) but not more than 25% of the company's net profit before Federal income taxes.

Then there are other benefits — a medical plan for the employee and his family, liberal vacations, holidays, etc.

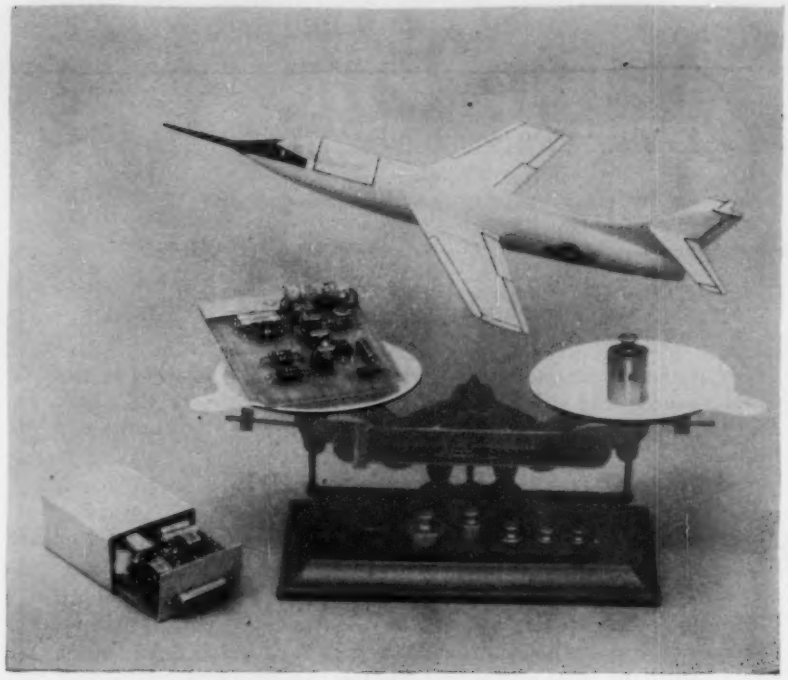
And, in addition, if you are an engineer who qualifies for the bonus plan, you share annually in a total pool of 5% of the net profit before taxes and after the trust contribution. Participation is on the basis of seniority and salary, and has averaged about six weeks' pay each year.

Why am I telling you this? Simply because Whittaker needs engineers, good engineers. The need has been created by company expansion, the purchase of other firms, and the consequent drive to build them to a par with the original Wm. R. Whittaker Company, which has led the aircraft valve field since World War II when it came up with the first motor-operated, gate type fuel valves.

And it's still leading — doing the largest volume of business in its field today, and looking forward to the challenge of tomorrow.

So, if you're an engineer—a good, experienced engineer, either an electronics man specializing in research, or a man experienced in fractional horsepower motors, both AC and DC —write Bob Whittaker, President, Wm. R. Whittaker Co., Ltd., 915 North Citrus Avenue, Los Angeles 38, Calif.

But first—check page 88.



trade excess weight for extra range with TI *transistorized* electronics

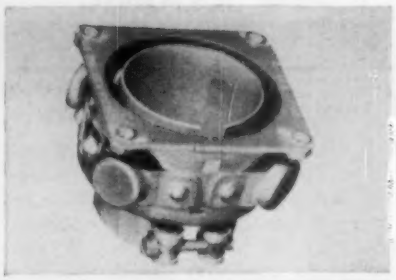
Utilizing high temperature silicon transistors . . . developed and mass-produced by Texas Instruments . . . the transistorized amplifiers illustrated weigh at least 90% less than comparable vacuum tube models. They are approximately 80% smaller . . and require only a fraction of the power needed for vacuum tube equipment. Such TI transistorization achievements help solve the aircraft industry's toughest design dilemma . . . more reliable electronic apparatus with less weight. TI transistorized equipment and systems . . . lightweight, compact, shock resistant . . . aid military aircraft manufacturers in designing for increasingly greater speed and range.

At TI, extensive military design and production experience is enhanced by leadership in transistor manufacture. Silicon transistors, mass-produced only by Texas Instruments, far exceed MIL-T-5422C temperature specifications and more than meet all military environmental specifications. The world's leading transistor manufacturer, TI also produces subminiature transformers, deposited carbon resistors and other precision components for high efficiency operation in miniaturized circuits.

Call on Texas Instruments to design and manufacture reliable electronic systems that will help solve your weight and space problems. You can depend on the experience and ability of TI application engineers. For further information, write to Texas Instruments, Apparatus Division.

TWENTY-FIFTH YEAR OF PLANNED GROWTH

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE DALLAS 9, TEXAS



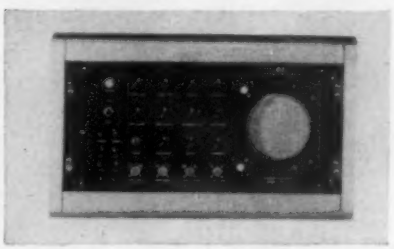
contains metal sleeve for supporting tube. Flexible electrical leads attached to the base of the tube socket give shock mount required freedom of movement. Robinson Aviation Inc., Teterboro, N. J.

Microwave Components

● **Heavy duty pulse transformer,** Type D211C4B, delivers 15,000 volts at 125 amps. Unit is designed to operate with pulse widths of 2μs and has a rise time of less than 1μs. Duty cycle is 4 milliseconds, continuous Maximum variation of output pulse from nominal peak value reportedly is less than 5%. Transformer is hermetically sealed and oil filled, with bellows-type expansion drum. Fisher Engineering, Inc., Huntington, Ind.

Laboratory Equipment

● **Oscilloscope "memory,"** an attachment for use with electrostatically deflected CRTs, can provide multiple storage of waveforms initially displayed on the oscilloscope. Waveform can be



erased at wall from the new Memo-Scope. For application data, write to Advanced Electronics Manuf. Corp., 2025 Pontius Ave., Los Angeles 25, Calif.

● **Sweep-Sync,** Model 201, is an automatic sawtooth generator which produces a linear time-base sweep that is exactly synchronized with an external reference signal, to permit waveshape display on an oscilloscope. Device can be used for distortion observation of shake testing during frequency scans, for checking the entire cycle during variation of pulse repetition rate, or for continuous monitoring of waveshape during frequency response tests. Price is $290 FOB. Chadwick-Helmuth Co., P. O. Box 321, Monrovia, Calif.

NEW AVIATION PRODUCTS

Valve Helps Balance Fuel Tanks

Hydro-mechanical fuel balance system holds center of gravity within 1% of mean aerodynamic chord through automatic sequencing of fuel tanks widely dispersed from the CG. Control unit senses full heads and feed information to control valve shown above which operates shut-off valve between tanks.

Desired fuel head difference is held to plus or minus ½ in. over the complete range of flows, temperatures and flight attitudes up to 20 degree climb or dive.

Grumman is using this system on the new F11F-1 model.

Parker Aircraft Co., 5827 W. Century Blvd., Los Angeles 45, Calif.

Stand Tests Hydraulic Accessories

New test stand gives performance data for almost all hydraulic system components and accessories, including valves, regulators, cylinders and actuators.

The unit tests variable pressure pressure control relief valves. Variable flows up to 10 or 20 gpm. are obtained by manual adjustment of a variable displacement pump.

Model 2682's weight is 1,500 lb. Dimensions are 7 ft. long, 40 in. deep, 76 in. high.

Auto Control Laboratories, 5665 Selmaraine Drive, Culver City, Calif.

Film Resists Rocket Fuels

A film made of Bakelite fluorothene resins only .004-in. thick is being offered as protection for delicate instruments from extremely corrosive atmospheric conditions. It will withstand fuming nitric acid and hydrazine, which are used as rocket fuels.

The film has a tensile strength of 25,000 psi and a high dielectric strength over a wide range of temperature and humidity conditions, providing a positive and heat-resistant insulation for resistors, condensers, transformers and other electrical components.

W. S. Shamban & Co., Culver City, Calif.

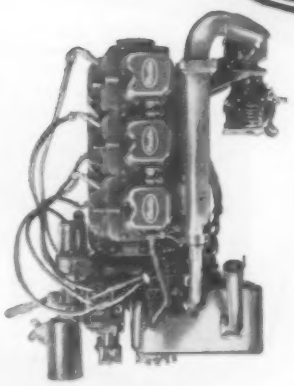
Timer Clocks Machine Guns

Automatic chronograph measures velocity of bullets fired from rapid-fire machine guns. The device measures the number of rounds fired per minute

4 out of 5

helicopters under 400 hp. produced this year will have power by

Franklin
FINE AIRCRAFT ENGINES



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WHAT CATEGORY OF ENGINEERING INTERESTS YOU?

Lockheed's, Georgia Division Engineering Branch, long range expansion program requires qualified Engineers in all fields: Design, Research, Laboratories, Structures, Flight Test, Dynamics, Preliminary Design, Operations Research------!

Advanced projects in large aircraft categories, Cargo, Bombers, Logistic Carriers are among the complex and interesting assignments in which this organization is actively engaged.

Qualified Engineers interested in becoming associated with this progressive Engineering Organization are invited to write to us in complete confidence.

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761 PEACHTREE N. E., ATLANTA, GEORGIA

and the individual velocities of each round. The sensing devices are two photo-electric detector screens spaced far enough apart that no two rounds appear at the same time. From 10 to 9,000 rounds/min. can be measured.

The system also consists of a data recorder and a data processor. Another feature of the chronograph is the count transfer pulse generator which, upon receipt of a readout signal, transfers the data from the time of flight counter to an accumulator in pulses, thereby introducing new information into the accumulators as it is received.

Potter Instrument Co., Inc., 115 Cutter Mill Road, Great Neck, N. Y.

Portable Hydraulic Tester

A portable hydraulic test machine has been designed for use aboard aircraft carriers, in aircraft shops and industrial quarters where equipment or work calls for a low-slung, maneuverable machine.

Available in 10 and 20-gal. capacities, the former stands 32 in. high and the latter 36 in. Both models are equipped with pneumatic tires on ball bearing mounted wheels.

The machines are used to test the performance and operation of hydraulic systems and components of aircraft and other equipment. They drain and filter the hydraulic fluid and refill the hydraulic system. Leakage can be detected whether internal or external.

Greer Hydraulics, Inc., Jamaica 30, L. I., N. Y.

Enclosed Aircraft Motor

Aircraft motor suitable for blower drive, pump driver, actuator, delivers ¼ hp. continuously at 5,700 rpm., operating on three-phase 400-cycle, 208-v. a.c. Starting torque is 4.5 in. lb. maximum altitude level is 50,000 ft.

Type SDVA motor weighs 6.5 lb., is cooled by a fan which blows air over the ribs of the frame. It is also available in explosion-proof Type SEVA.

Aircraft Div., U. S. Electrical Motors Inc., Box 2058, Los Angeles 54, Calif.

Filters for Avgas and Jet Fuel

Three new separator filters for handling both aviation gas and jet fuel at a rate of 225 gpm. while removing

PANELOC announces a new rotary latch

Saves Cost • Saves Time
Saves Space • Saves Weight

This new Paneloc Rotary Latch is a simple and economical, strong and durable fastener for access panels, electrical control panels, inspection doors, machinery doors, and other hinged or removable covers. It permits a larger access opening, operates quickly with a quarter-turn. Entire assembly on access panel itself, eliminating many installation steps; no special tools required. Only four simple parts; made of steel, cadmium plated. Three standard sizes now available, more to be added. Special sizes and finishes available on order. Cost very low, performance unsurpassed. Write for a catalog and price list for your file.

PANELOC...America's most versatile line of aircraft fasteners . . . Rotary Latches, Styles 1, 2, and 3 Panel Fasteners, High Performance Fasteners, Snap Fasteners.

PANELOC—A product of Scovill

Scovill Manufacturing Company, Aircraft Fastener Div.
4 Mill Street, Waterbury 20, Connecticut

Please send me fastener catalogs checked:

( ) Rotary Latch ( ) Style 3 (MIL-F-5591A)
( ) Styles 1 & 2 (MIL-F-5591A) ( ) High Performance (NAS-547)
( ) Snap Fasteners (AN 227)

Send to:

Name_____ Title_____

Company_____

Address_____

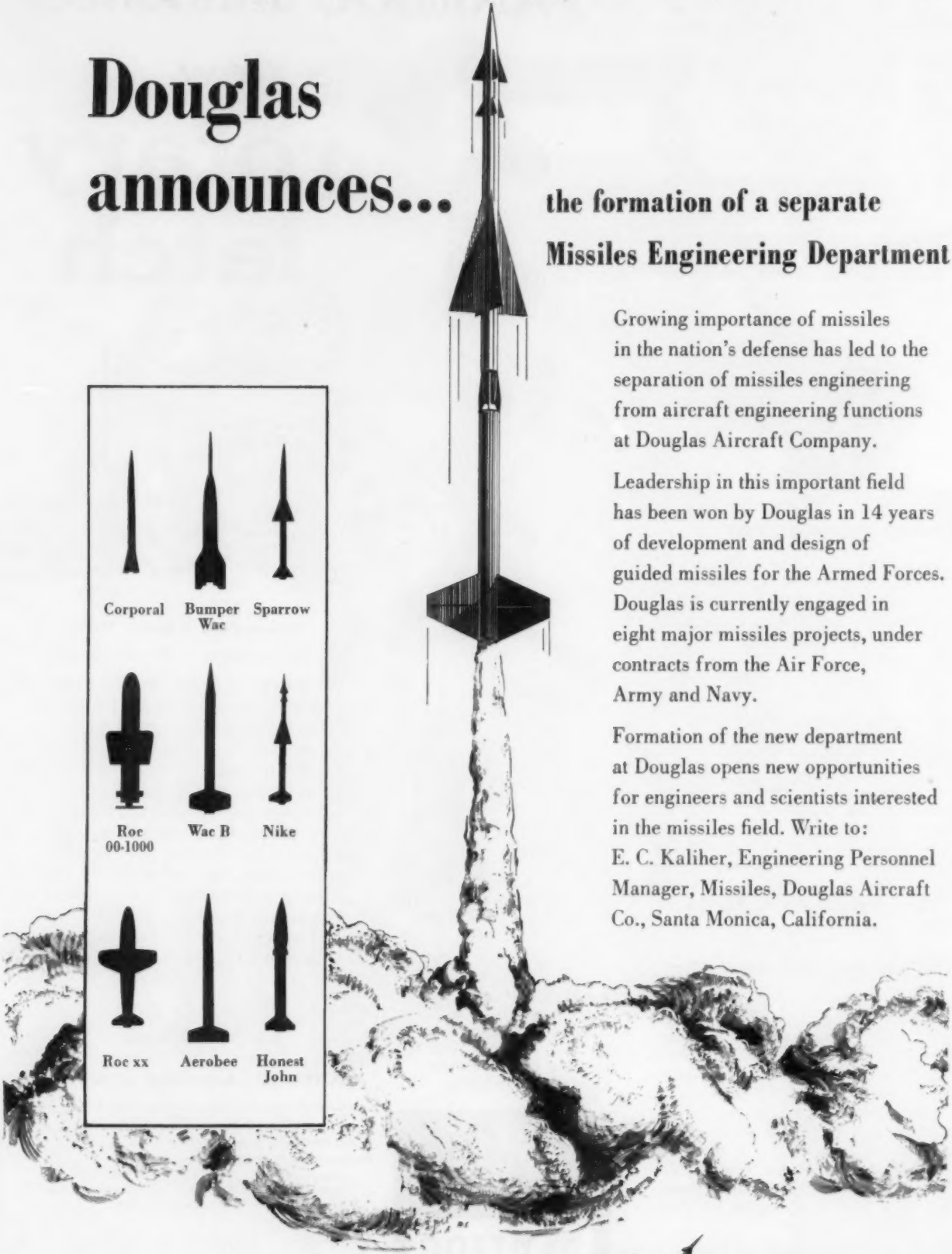
Douglas announces...

the formation of a separate Missiles Engineering Department

Growing importance of missiles in the nation's defense has led to the separation of missiles engineering from aircraft engineering functions at Douglas Aircraft Company.

Leadership in this important field has been won by Douglas in 14 years of development and design of guided missiles for the Armed Forces. Douglas is currently engaged in eight major missiles projects, under contracts from the Air Force, Army and Navy.

Formation of the new department at Douglas opens new opportunities for engineers and scientists interested in the missiles field. Write to: E. C. Kaliher, Engineering Personnel Manager, Missiles, Douglas Aircraft Co., Santa Monica, California.



Missiles by *DOUGLAS* **First in Aviation**

all of the water and better than 99% of the solids have been put on the market.

Two of the models, PASF-225J and PASF-225H, are Navy-approved. They are constructed of aluminum bronze. Both models meet MIL-F-8508 specifications.

The third filter is a commercial adaptation of the military separator filter, a horizontal two-stage separator identical to Navy model PASF-225J. The unit has a steel body and aluminum division plates and element parts and can be mounted horizontally in the rear bucket box compartment of refuelers or on carts.

Purolator Products, Inc., Rahway, N. J.

ALSO ON THE MARKET

Rotary table, Palmgren No. 86, has an 8 in. diameter top with $\frac{3}{8}$ x $1\frac{1}{8}$-in. T slots crossing at center, which is bored for a $1\frac{1}{2}$-in. locating plug. Table is graduated 360 deg. and rotary feed is positive through worm and gear with 40:1 ratio.—Chicago Tool & Engineering Co., 8383 S. Chicago Ave., Chicago 17, Ill.

Pocket-sized surface comparator permits metal surfaces to be compared with a selected standard for roughness under 10-power magnification. The in-

strument is self-illuminated with two pen-light batteries and a standard PR-4 flashlight lamp. Price: $30.—Bausch & Lomb Optical Co., 625 St. Paul St., Rochester, N. Y.

Synchro-Snap centrifugal switches are furnished in separate packaged unit. Controls utilize up to three independent governors for control of multiple or inter-related circuits. Applications include radar equipment and guided missile control.—Torq Engineering Products, Inc., Bedford, Ohio.

PLASTIC-ENCASED HEATER ANOTHER SAFEWAY FIRST

Multi-circuit element, measuring 15" x 58" on a 34¾" radius, made for the Raytheon Manufacturing Company for use in metal-to-metal bonding.

Method Evolved by Pioneer in Field of Woven Heat Elements

New Molded Unit Provides Own Structural Support

A method has been devised to enclose woven heat units within rigid fiberglas reinforced plastic. Where essential to combine heat with high physical strength, these elements, molded into various shapes and sizes, are ideal.

Withstands Severe Environment

Highly desirable characteristics are an exceptionally broad temperature range of −80°F to more than 600°F, excellent dielectric qualities, and protection of the heat unit itself against damage.

Diversity of Applications

Reinforced plastic heat elements have countless uses, notably in aircraft as heaters and de-icers. In other industries, there are innumerable applications, such as dryers, warming ovens, heated trays and molds, adhesive bonding fixtures, stretch form dies, and food warmers.

Many Uses Still Unexplored

The vast potential of this product lies in many fields beyond our experience. SAFEWAY engineers would like to confer with you if your heat problems might possibly be solved by the use of tailor-made reinforced plastic heat elements.

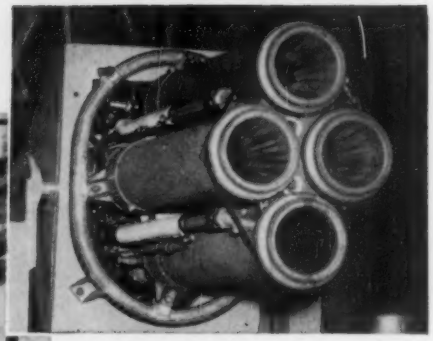
Literature Available

Diversified needs may be more effectively satisfied with neoprene or silicone rubber insulation. *For your copy of a fact-filled folder, write to:*

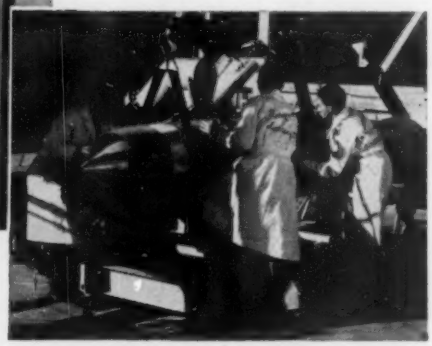
Safeway HEAT ELEMENTS INC.

680 NEWFIELD STREET • MIDDLETOWN, CONNECTICUT

new team impetus...



In the field of fuels research, Olin Mathieson and Reaction Motors are developing new liquid and solid propellants as well as additives to improve current propellants. Reaction Motors and Marquardt Aircraft establish specifications for these new rocket and ramjet fuels and test and evaluate their capabilities for meeting tomorrow's needs.

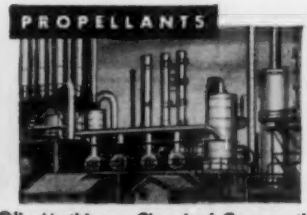


developing super fuels for supersonic propulsion

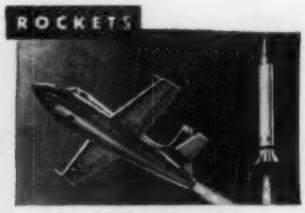
Applying the modern "weapons system" concept to the problems of supersonic propulsion, Olin Mathieson, Reaction Motors, and Marquardt Aircraft are combining their unique skills and experience in the development and production of rockets, ramjets, and special fuels. Coordinated by the OMAR Joint Technical Committee comprised of representatives of the three companies, this applied research program is dedicated to the practical advancement of supersonic aircraft and missile propulsion.

3519

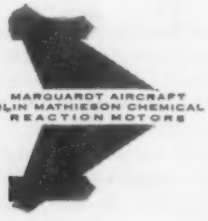
Marquardt Aircraft Company



Olin Mathieson Chemical Corporation



Reaction Motors, Inc.



LETTERS

On 'Super Secrecy:'

Sound Thinking . . .

I have just finished your editorial of Oct. 31 (page 98) in AVIATION WEEK and wish to compliment you for the sound thinking it describes. Well done!

ROBERT L. SMITH
Executive Vice President
Bobrich Products Corp.
Beacon, N. Y.

. . . Or Security Error?

What is this "super secrecy" policy you speak of in your editorial appearing in the 31 October issue? Are these the policies that make it so easy for publications such as AVIATION WEEK to release voluminous material on contemporary technology? Sure, you stick to the rules, you don't print anything that's classified—or do you? The fact of the matter is that we have today such a free exchange of military information that the constant repertorial indulgence in the shadowland of security has made security a joke. The Russians don't need spies, all they need do is subscribe to all of the leading trade publications—it's all there, in print, in photos, in diagrams.

Contrary to the views of Lauren D. Lyman, I see no possibility of creating an "intellectual aristocracy." We do not live by a "need to know" *philosophy*, but rather by "need to know" *security regulations* which apply to technological advancements, the compromise of which would be detrimental to the security of the United States.

Sure, the red tape of government regulation is sometimes frustrating and inequities are bound to exist. The fact remains we MUST have security. And the security we have will always be a compromise. To what avail is our hard earned technological advancement if our potential enemies are allowed our secrets almost simultaneously. Lack of security is what has actually hampered development. The speed of our development is relative to the speed of Russian development. As long as they are running along side of us, we can never pull ahead.

Your editorial should have been advocating tighter security enforcement. Ah, you say, (using the well-worn cliché) this man wants to "gag the press," destroy one of our most cherished freedoms. Nothing could be farther from the truth. I do suggest that the "press" use better judgment in the light of our security problems. Statistical information on a new guided missile may be "hot news" and help circulation, but the public does not "need to know" the details.

Your article in the same issue describing "USAF Tactic for Aerial Warfare" is a good case in point. It was interesting, but the only concrete purpose it served was to help the Russians. I think if you checked, you might also find you are flirting with security violation. I recognized the Hughes equipment which you photographed and, according to my information, it is classified CONFIDENTIAL.

GORDON R. DAGGY
Plymouth Meeting, Pa.

(EDITOR'S NOTE: READER DAGGY SHOULD KEEP HIS FILES UP TO DATE. THE MATERIAL HE CITES AS STILL LABELED "CONFIDENTIAL" ON NOVEMBER 3, WAS OFFICIALLY CLEARED BY THE DEFENSE DEPARTMENT FOR PUBLIC USE ON SEPTEMBER 30.)

Reply to NATA

Your letter column of October 10 carries a note from a Mr. Charles Parker, Executive Director of NATA, refusing to sympathize with Remmert-Werner's complaint of the airlines' government protected competition against unprotected private operators. He takes us to task for "disregarding industry organization and Washington representation," not joining NATA and not trying to "help make an organized effort successful."

We were not aware that the administration of justice, which is all we asked, required membership in Mr. Parker's NATA or any other of the more than eighty various organizations, institutes, foundations, associations, societies, clubs, conferences, corporations, commissions, councils, boards, panels, committees or other recognized aviation groups in the country today.

We would dearly love to have the time and money available to participate in Mr. Parker's NATA and NAMC, as well as the MPA, ARF, ATS, IAACA, AFA, AF, ATCA, ATAA, AIAA, AOPA, ASA, AOC, AAA, AAAE, AMA, APIC, ADMA, FSF, IADA, IAS, IAW, MAA, NAC, NAA, NPA, NATC, NAS, NAEC, NBAA, NFAA, NSC, NN, U. S, State, and local Chambers of Commerce, Rotary, Kiwanis, Boosters, Conference of National Aviation Organizations, and all the others. We do belong to several of them now and are sure that the rest of them are worthy, too, but we do have to squeeze in an odd moment of work occasionally in order to keep our dues paid in those we did join.

We are positive that Mr. Parker's particular organization could resolve the complaint in question, because he himself says that it is working on the problem right now and are sure that the present growth of the problem is probably just coincidence, anyway. We certainly wish him and the

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Engineers

OPPORTUNITIES with established flight research organization engaged in all phases of flight test work.

Systems Installation

Electrical and hydraulic systems and associated detail component installation in airframes.

Aircraft Structures

Airframe structural layout and stress analysis.

Instrumentation

Development and flight test of all forms of aeronautical instrumentation.

Flight Test

Engineers with experience in flight testing of airframes and/or flight control equipment.

SUBMIT RESUME
Att: Robert Stewart
or
Phone for Appointment
RONKONKOMA 9-8086
(RONKONKOMA, N. Y.)

SPERRY

GYROSCOPE COMPANY
Division of Sperry Rand Corp.
P.O. BOX 218
RONKONKOMA, L.I., N.Y.

There is an important place for you at CONVAIR-FORT WORTH if you have the qualifications and desire to perform vitally essential work in these technical areas.

AERODYNAMICS

Lift and Drag Prediction of Aircraft and Missiles—
Aerodynamic Loads—Wind Tunnel Testing—
Performance of Aircraft and Missiles—
Cruise Control
Flight Test Data Analysis

AEROPHYSICS

Stability and Control of Aircraft and Missiles
Analysis of Fire Control
and Electronic Countermeasure Systems
Systems Engineering—Including Navigation,
Missile Guidance, Radar and Microwaves

STRUCTURAL ENGINEERING

Stress and Deflection Analyses—Materials Research
and Development—Preliminary Design—
Aerodynamics of Steady and Non Steady Flow—
Flutter Model Design—Electronic Computer Programming—
Fatigue Problems

Attractive openings also exist in other technical areas.

As a division of General Dynamics Corporation, CONVAIR occupies an important place in the long-range development of the Nation's aerial defense as well as commercial aviation. CONVAIR'S activities afford inviting career opportunities for engineers, physicists and scientists — opportunities for professional accomplishment and personal income.

At CONVAIR-FORT WORTH you work in ideal, air-conditioned surroundings. A company-sponsored, in-plant program enables candidates to earn graduate degrees in Engineering. CONVAIR offers liberal travel allowance, paid vacations, excellent insurance and retirement programs.

Fort Worth in the Great Southwest has an abundance of sunshine and dry, fresh air conducive to outdoor living and recreation. Within a few minutes drive of Fort Worth are seven large lakes which provide ample facilities for fishing and other water sports.

For further details write M. L. TAYLOR
CONVAIR Engineering Personnel Dept. A
Fort Worth, Texas

CONVAIR
FORT WORTH

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
FORT WORTH, TEXAS

NATA the best of all luck, too, in the Washington representation at top level that Remmert-Werner is guilty of disregarding, and, to prove it, would like to offer the free advice that he avoid certain top levels who have expressed strong public and private opinions about the inordinate amount of representation loose in Washington today.

However, somebody has to keep working on airplanes so there will be an industry to have so many nice organizations representing it, and we're willing to be the ones to do it, even it it means giving up some of the membership badges and missing some of the conventions. Our regrets to Mr. Parker.

William F. Remmert
Remmert-Werner, Inc.
Lambert Field
St. Louis 21, Missouri

Strike at Arma

Correction please! The news item on the Arma strike in the October 24th AVIATION WEEK stated that Arma management has offered a 5% wage increase to its engineering employes who are represented by the Engineers Association of Arma, an affiliate of the Engineers and Scientists of America. In actuality, the management offer was only 5¢ per hour, not 5%.

There is a great deal of difference between these figures. A 5¢ increase for the average assistant engineer equates to only a 1.53% increase. For senior engineers, it would come out to only 0.88% increase.

As you correctly stated in your article, management "wants to negate certain fringe benefits now in force." These "fringe benefits" are very important to the professional development of the Arma engineers and provide assurance of fair employment conditions. For instance, Arma management wants to cut the annual pool allotted for merit and length of service increases from 7.81% of the total payroll to a merit kitty pool of 5.5% of only those eligible for merit increases. The 5.5% calculation would not include personnel in automatic increase ranges or those who have reached the maximum of a given salary range.

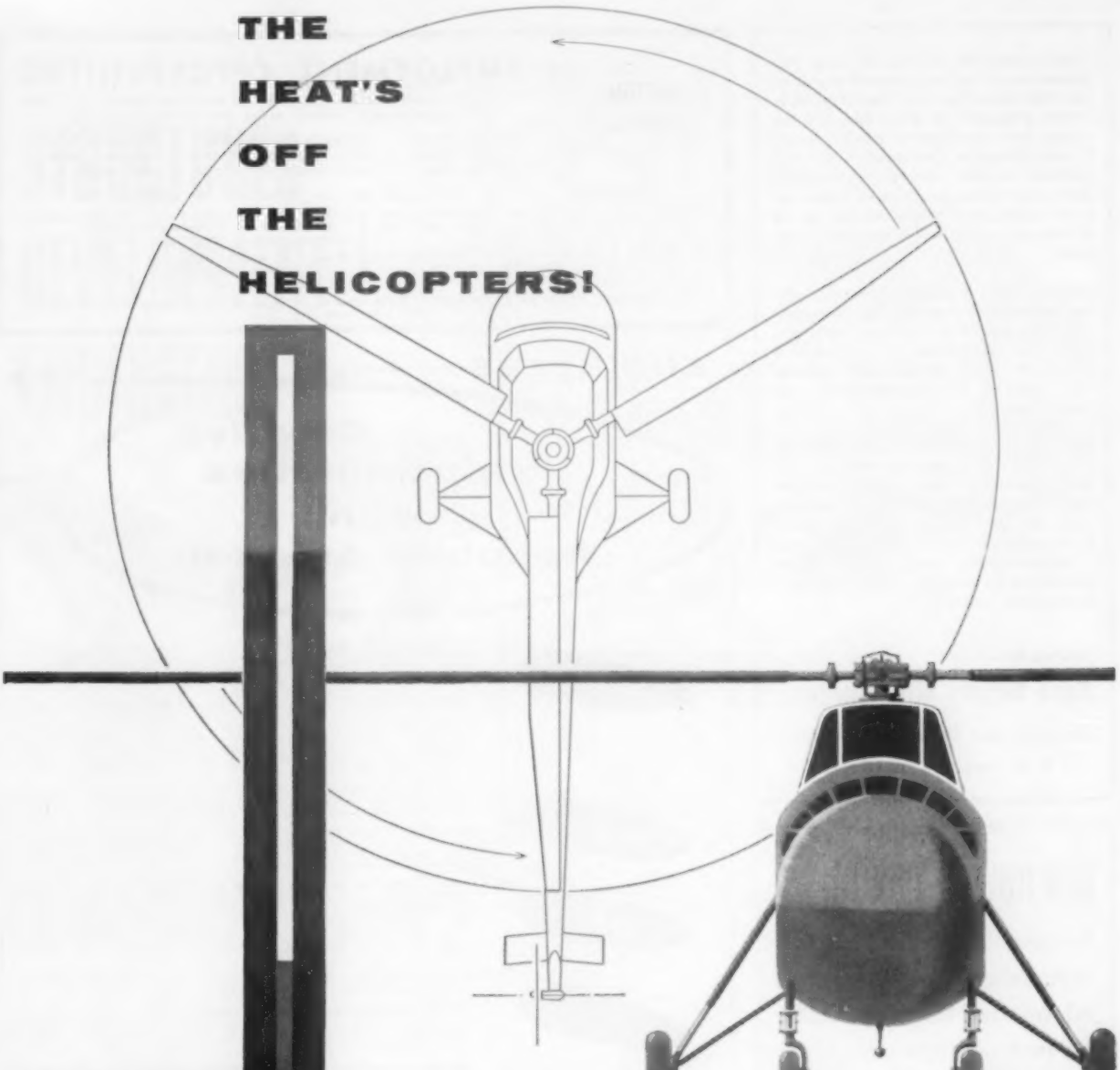
Arma management also is demanding the elimination of the past practices clause, which provided that beneficial past practices or policies not explicitly covered by the contract would nevertheless be continued. Apparently, they intend after contract negotiations to make Arma a less desirable place to work.

Although the member groups of the Engineers and Scientists of America abhor strikes, we full well realize that it was necessary for the Arma engineers to take strike action to protect the Arma Company from the unreasonable demands of management. We stand with the Engineers Association of Arma, and will do everything possible to assist them, as we did in 1953, in this struggle.

John E. Taft
Vice President
Engineers & Scientists of America
178 Hillside Avenue
East Williston, New York

(Aviation Week erred. Management's offer was 5¢, not 5% as reported—Ed.)

THE HEAT'S OFF THE HELICOPTERS!



A struggling infant a few short years ago—*now the 'copter has won everyone's confidence!* And Harrison oil coolers helped them make the grade—enabled them to fly faster . . . farther . . . with bigger, more profitable payloads. Harrison's unexcelled research facilities deliver the designs that save space and weight. In fact, Harrison is *always* looking for new ways to make aircraft heat exchangers of all kinds lighter, more dependable, more durable than ever! If you have a cooling problem, look to Harrison for the answer!

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

HARRISON

TEMPERATURES MADE TO ORDER

Aero Supply Mfg. Co. Inc. of Corry, Pa., announces a series of general engineering data bulletins of a non-advertising nature prepared by Aero Supply's Research and Development Center recently established in Cleveland, Ohio. The bulletins consist mainly of technical data with charts, graphs and other valuable information related to the design of aircraft, rocket and missile fuel systems.

The first four bulletins show viscosity vs. temperature data for approximately 120 different fluids and has been prepared for availability on or about September 6, 1955. Subsequent bulletins will appear at approximately one month intervals.

For over 39 years Aero Supply Mfg. Co. Inc. has been a leading designer and manufacturer of fuel system components, cockpit controls and related articles for all flight applications. Qualified representatives and engineers are readily available upon request to offer assistance on specific engineering and application problems.

Address Request to

Aero Supply Mfg. Co. Inc.,

Research and Development Center,

P. O. Box 402, Corry, Pa.

NEW BUYERS' GUIDE DATE

Because more than 2,800 companies have supplied information for some 25,000 product listings to date AVIATION WEEK BUYERS' GUIDE announces a later mid-December publication date. This unprecedented response has resulted in a tremendously increased work load and substantially larger production problems. The new publishing date will allow the additional time necessary to publish the edition on the same high level of editorial quality originally announced.

NATIONAL COVERAGE

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant | **Civil Service Opportunities** | **Employment Agencies**
Positions Wanted | **Selling Opportunities Wanted** | **Employment Services**
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The advertising rate is $23.35 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

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$1.80 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

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Send NEW ADS to AVIATION WEEK, 330 W. 42nd St., N. Y. 36, N. Y., for December 5th issue closing November 25th

ENGINEERS

Creative Opportunities with Republic Aviation

Aerodynamics

AERODYNAMICIST An aerodynamics engineer (3-4 years experience) experienced in analysis of aerodynamic data and stability problems. To investigate stability and control problems under supervision. Extremely interesting work in advanced problems.

AERODYNAMICIST Man with ability to combine theoretical and practical aerodynamics to determine aerodynamic load distributions and to work in the field of aeroelastic analysis. A background knowledge of compressible and incompressible flow of perfect fluids and an understanding of basic engineering mathematics is desirable. This position offers an exceptional opportunity for professional development in fundamental aerodynamic analysis.

Flight Test

AERODYNAMICIST For Flight Test Engineer position. Aero education and experience with stability required. To work on planning and analysis of high speed experimental flight programs.

MATHEMATICIAN For Flight Test Engineer position. Math education required, aircraft experience preferred. To work on application of automatic computing procedures for flight data. An opportunity to develop new techniques in an expanding field.

Research

ELECTRONIC INSTRUMENTATION ENGINEER Three to five years aircraft instrumentation experience required. Knowledge of transducers, amplifiers and recording equipment used in experimental research testing of hi-speed jet aircraft is essential. Knowledge of servo loop theory as applied to aircraft systems coupled with ability to properly instrument, record and analyze is desirable. Graduate with E.E. degree preferred.

Thermodynamics

Specialized openings for Thermodynamics engineers in the following categories. B.S. in M.E. or A.E. required.

SENIOR THERMODYNAMICS ENGINEERS (1) Four years experience with engine control systems. (2) Inlet specialist. Four years experience on both subsonic and supersonic design. (3) Four years experience in heat transfer.

Flutter & Vibration

SENIOR DYNAMICS ENGINEER Position open for a qualified engineer to work on flutter problems of supersonic aircraft and direct work of other engineers. Opportunity to work on the most advanced high performance aircraft which will challenge the ingenuity of the man who takes this job. Several years experience in flutter analysis required. Chance for advancement good.

Stress Section

SENIOR STRESS ANALYST Engineering degree with a minimum of 3 to 5 years stress analysis and design experience on major airframe components.

SR. WEIGHTS ENGINEER A.E. or M.E. degree preferred. Two openings for weights engineers with 2 or more years experience at the senior level. One with structural weights experience; the other requires thorough knowledge with aircraft systems as they affect the weight problem.

NOTE THESE REPUBLIC BENEFITS

You'll enjoy a top salary scale, and important personal benefits: life, health and accident insurance up to $20,000, company paid, plus hospital-surgical benefits for the whole family; and 2/3 of the cost of collegiate and graduate study.
NEW ALL-EXPENSE-PAID RELOCATION PLAN, for those living outside the New York City and Long Island area, relieves you of all financial worries. The company pays interview expenses for qualified candidates; actual and reasonable costs of insured moving of household and personal effects, and where necessary, free storage up to 30 days. Also $10 per diem up to 30 days, while getting settled. And of course you'll live and work on fabulous Long Island, playground of the east coast.

Please address complete resume, outlining details of your technical background, to:

Assistant Chief Engineer
Administration
Mr. R. L. Bortner

REPUBLIC AVIATION
FARMINGDALE, LONG ISLAND, NEW YORK

STRUCTURES DEVELOPMENT ENGINEERS

One of the great problems to be overcome in man's conquest of the air, and beyond, is to resolve the conflict between changing design requirements resulting from new configurations of increased performance, and the need for a lightweight, efficient structural design. New materials and structural arrangements must be mated to minimize the effects of aerodynamic heating while keeping in mind that structural considerations are only one important part of making the final design a working system.

Personal opportunities for imaginative and creative structures engineers are greater than ever before and may be realized immediately here at Chance Vought. Outstanding positions involving responsibility for the design and development of advanced military projects are available at the Senior, Lead, and Project level.

These various technical assignments include the stress analysis of complex aircraft structures, determination of design loads, structural research and development, thermal stress analysis, project weight control, aeroelastic analysis, and the application of structural design methods to high speed computing machines, as well as providing the necessary technical guidance to the design sections.

Some of the positions currently open require direct experience in aircraft. However, engineers from related technical fields or men with advanced degrees and less experience may find that they are qualified for these positions and will benefit by investigating the many advantages engineers enjoy at Chance Vought.

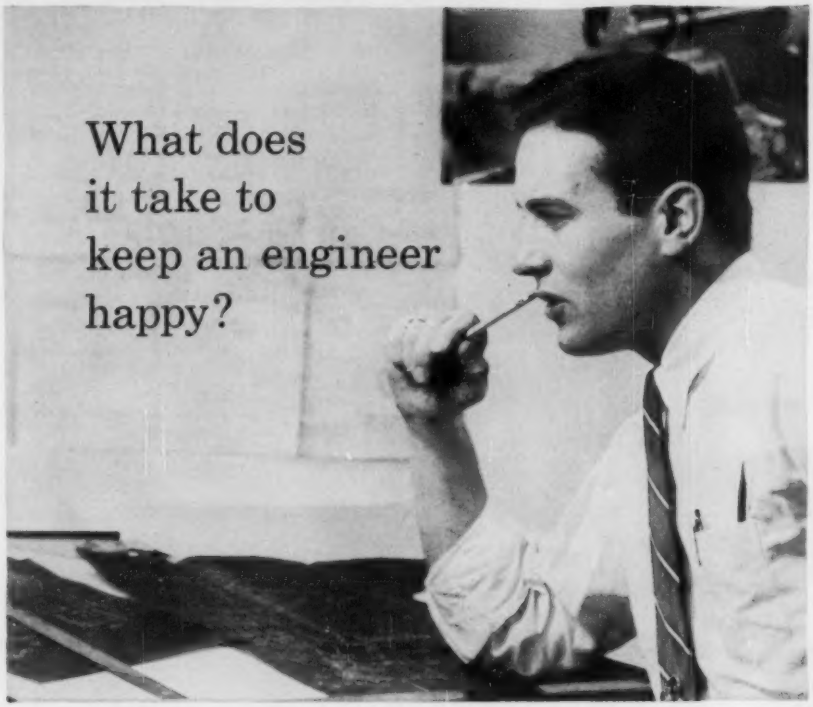
Current Chance Vought projects include the F8U-1 "Crusader", the world's FASTEST Navy fighter and the "REGULUS" missile.

To arrange for a personal interview or a prompt and confidential evaluation of your place on Chance Vought's engineering team, contact:

Engineering Personnel

CHANCE VOUGHT AIRCRAFT
INCORPORATED

P. O. Box 5907
DALLAS, TEXAS



We think we have the answers here at Wm. R. Whittaker Co., Ltd.

Here's what an engineer can expect to find when he joins our organization – see if you don't agree:

To begin with, we assume that when a man has put in the kind of labor and sweat it takes to get his degree, he wants to be just that – an engineer. This means he wants the opportunity to contribute ideas, to feel that his creative ability is recognized, to feel that his achievements are appreciated and *rewarded*.

That's how Whittaker feels, too.

Maybe it's because our president, Bob Whittaker, is himself an engineer. Maybe it's because his habit of taking a personal interest in the engineers has set the tone for the entire organization.

Whatever the reason, a newly hired engineer at Whittaker soon makes the pleasant discovery that he is working in a relaxed and pleasant atmosphere – where doors are always open to him.

He also finds that Whittaker's project engineering system gives him a chance to follow a given job from proposal right through to production.

On top of this, he and his family share in the gracious, easy, informal life of Southern California. He enjoys a generous retirement trust fund plan, frequent salary increases, family medical plan, liberal vacations. And, on the basis of salary, he can qualify for the bonus plan which has averaged about six weeks' salary every year.

Sound attractive? We will be happy to receive your resume – especially if you qualify as either:

1. An electronics man specializing in research
2. A man experienced in fractional horsepower motors both AC and DC

An expense-free interview can be arranged. For further details, see "Valve Talk" on page 75. Then write Bob Whittaker, President, Wm. R. Whittaker Co., Ltd., 915 N. Citrus Ave., Los Angeles 38, Calif.

Whittaker

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Bendix York offers both!

As a young, expanding Division of Bendix Aviation Corporation, Bendix York is adding key personnel RIGHT NOW! . . . It's your chance to get specific assignments at the peak of the art in electronics and microwave development and design. Good salaries, all employee benefits, ideal suburban living conditions. Openings for Principal, Senior and Junior Electronic Engineers, Mechanical Engineers, designers and draftsmen.

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Bendix
AVIATION CORPORATION
York
DIVISION
York, Penna. York 5521

what helps a scientist grow?

Here are four factors given by distinguished Avco scientists. They reflect both the thinking and opportunity at Avco Advanced Development Division.

"Top-level associates"

says Dr. Arthur Kantrowitz, noted authority in gas dynamics, member of Avco Advanced Development, and professor, Cornell University.

"A scientist's effectiveness depends on mental stimulation provided by able associates. It's important at all levels and it is essential to a young scientist."

"Technical sophistication"

says Dr. E. R. Piore, former chief Scientist and Deputy Chief of the Office of Naval Research, now Avco V.P. and Chairman of its Committee on Advanced Research.

"The more advanced, more challenging, the more technically sophisticated his work—the better a talented scientist will respond."

"An atmosphere of inquiry"

says Eaton H. Draper, noted nuclear weapons systems expert and Engineering Manager of Avco Advanced Development Division.

"Provide a climate which encourages a healthy questioning of the known, as well as the unknown, and a scientist or engineer will perform at his peak . . . and even beyond."

"Freedom from routine"

says Dr. Mac C. Adams, noted aerodynamicist, author of papers on aerodynamics and gas dynamics, and Director of the Avco Research Laboratory.

"A scientist is most effective when he is free to direct his full energy against major problems. Adequate technical assistance releases him from time-consuming routine."

Helping talented scientists and engineers—at all levels—become more effective is the best way we, at Avco Advanced Development, know of helping our own growth. For that reason, we offer them assignments worthy of their abilities, stimulating associates, and the fullest technical support possible. Add to these factors the unique combination of small-company flexibility and large-company stability—and you have an environment ideally suited to growth. For outstanding men, Avco's long-range expansion—in missiles and in all the physical sciences—offers unprecedented opportunity.

Write Dr. E. R. Piore, Vice-President in Charge of Research, Room 409, Avco Advanced Development Division, Stratford, Conn., or Phone Bridgeport, Conn., DRexel 8-0431.

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Leaders in the exploitation of new areas of Science

Physical Scientists

Advanced degree preferred — in Physics • Aerodynamics • Electronics • Metallurgy • Physical Chemistry • Mathematics

Engineers

Electronic • Mechanical • Aeronautical • Chemical

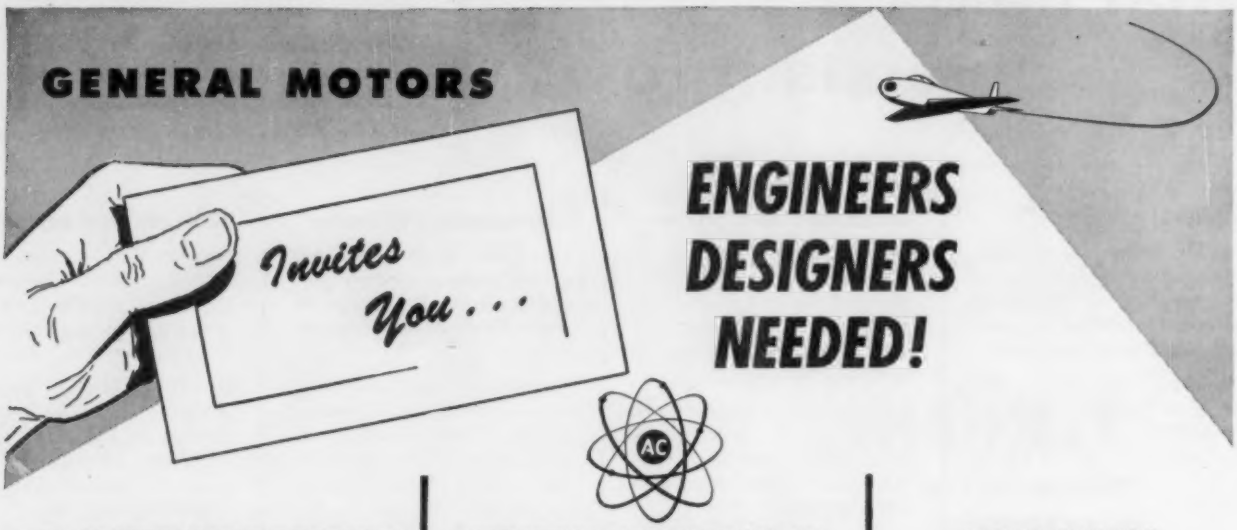
avco MFG. CORP.

advanced development division

avco defense and industrial products

combine the scientific skills, and production facilities of 3 great Avco divisions of Avco Manufacturing Corp.: Avco Advanced Development; Crosley; Lycoming which currently produce power plants, electronics, air-frame components, and precision parts.

GENERAL MOTORS



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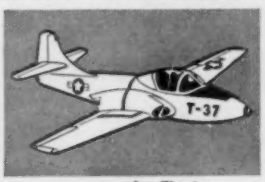

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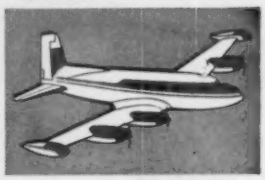
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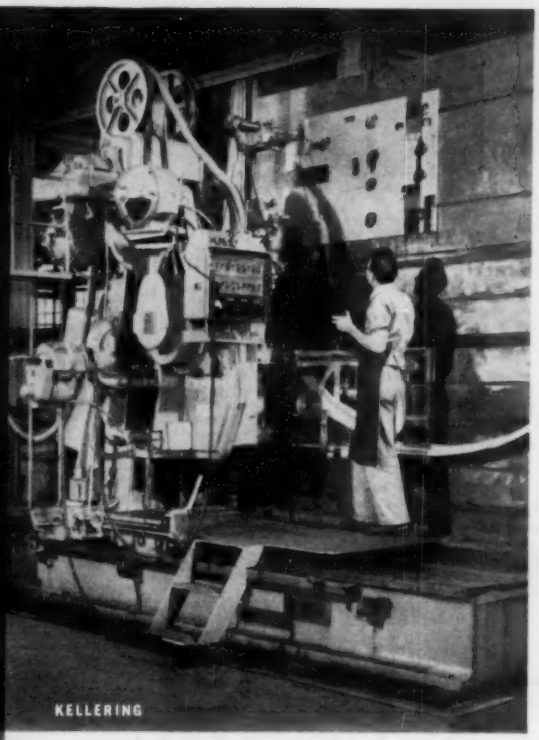

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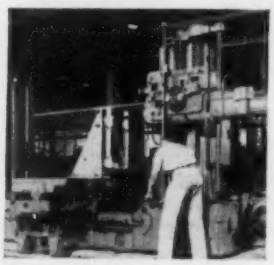

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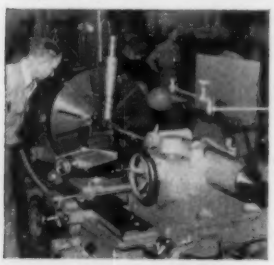

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WHO'S WHERE

(Continued from page 9)

Wayne G. English, treasurer of Aeroquip Corp. Other changes: **Kent R. Manning**, general manager, and **Dan Ruple**, control manager of the Jackson Div.; **George Lagassa**, plant manager of Elbeeco, Inc., a Jackson subsidiary of Aeroquip Corp.

H. Bryan Renwick, general traffic manager of Canadian Pacific Airlines.

Hudson Bullard, former technical director of U. S. Air Force (Guided) Missile Test Center at Patrick AFB, joined the staff of the University of Tampa as consultant to the director for guided missile applications.

Dr. L. L. Wheeler, chief engineer, and **Samuel Agabian**, works manager of Sperry Gyroscope Co., Div. of Sperry Rand Corp.

James M. Mitchell, associate director of the National Science Foundation.

Maurice K. Horan named sales engineer of the new West Coast office of Saginaw Steering Gear Div. of General Motors Corp.

S. Alfred Walker, public relations representative of General Controls Co., Glendale, Calif.

William J. Cushing, senior sales engineer of Defense Div. of Burroughs Corp.; **J. C. Lindley**, sales manager for Defense Contracts Organization.

Clifford A. Brooks, advertising manager for Pratt & Whitney Co., Inc.

Raymond E. Jacobson, manager of component and instrument sales for Electronics Div. of Curtiss-Wright Corp.

Thomas Linder, Jr., manufacturing manager of Chandler-Evans.

Frank L. Roberts, Washington representative of Chrysler Corp.

William A. Drum appointed to the Sacramento staff of California Aeronautics Commission.

Joseph M. Villata, agency and interline manager for Japan Air Lines' Los Angeles office.

Thomas J. Harris, director of cargo sales for American Airlines; **Theodore P. Gould**, sales manager for the Pacific Area.

Donald R. Spotz, general sales manager of Pesco Products Div. of Borg-Warner Corp.

Kenneth E. Snelling, customer relations representative for Downey Research & Development Labs. of Rheem Manuf. Co.

Rear Adm. Josephus A. Briggs (Ret.), Washington office of Cook Electric Co.

Harold L. Danziger, general sales manager of R. M. Hollingshead Corp.

John F. Harrigan, manager of instrument products dept. of contracts div. of Lear, Inc. **Paul O. Momenteller**, manager of electro-mechanical dept. of the division.

J. W. Stack, advertising manager of AC Spark Plug Div. of General Motors. Other changes: **Frank E. Ray**, marketing analysis manager; **H. L. Wardrop**, merchandising coordinator; **James P. Kane**, fuel pump merchandising manager; **Donald A. Maize**, assistant regional manager, Detroit; **Jack Church**, spark plug merchandising manager.

James H. Bechtold, manager of metallurgy dept. of Westinghouse Research Labs.

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1. Spin Motor: 12 Volts A.C., 400 cps, 2 phase
2. Power Required: Running 1.5 Watts—Start 2.2 Watts
3. Run-up Time: 15 Seconds Maximum
4. Angular Momentum: 10^4 Gram-Centimeter^2/second
5. Gimbal Travel: ± 5° Maximum
6. Signal Generator Sensitivity: 10 mv/mr, with 55 m/a, 400 cps
7. Signal Generator Linearity Deviation: ± 1%
8. Torque Generator Linearity Deviation: Less than 1%
9. Input Rate: 4 Radians/second Maximum
10. Drift Rate: 1° per hour maximum
11. Weight: 1.5 pounds

NOTE: *This Gyro can be readily modified to meet your requirements. We invite inquiries listing specifications.*

The Greenleaf Line of Gyros and associated devices is being steadily expanded. It now includes a wide selection of Free and Rate Gyros, and the HIG-3 and HIG-4 Gyros.

Write, wire or phone for further information.

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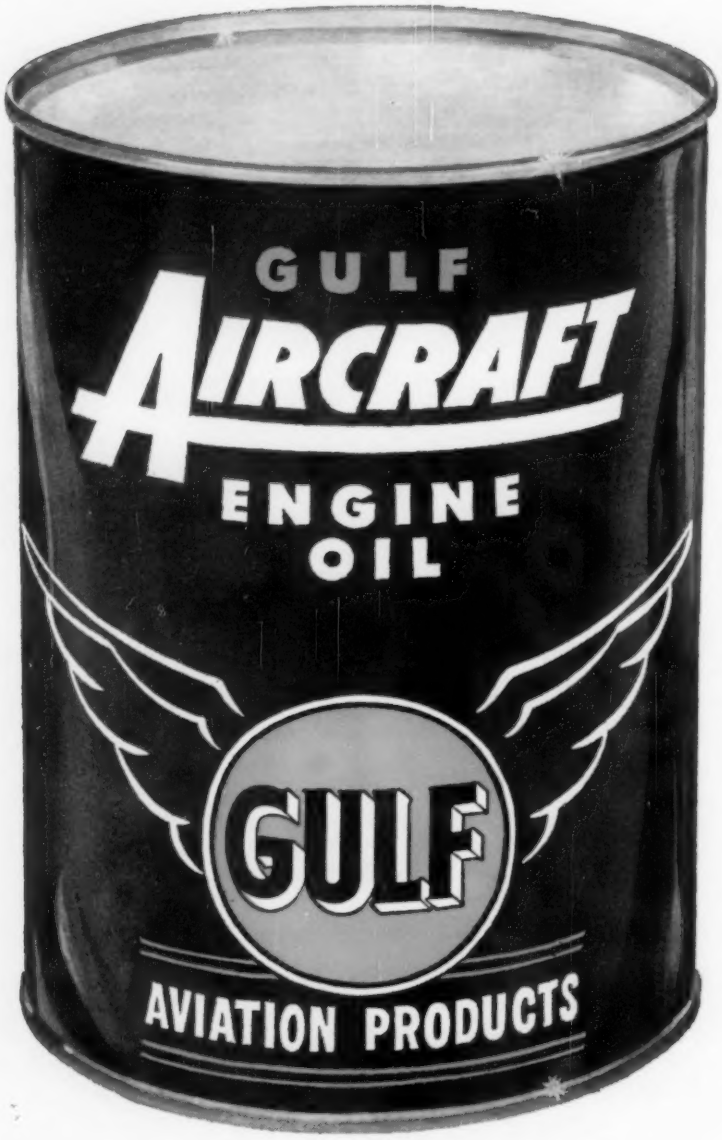
Producers of the HIG-3 and HIG-4 Gyros, Rate and Free Gyros, Differential Pressure Mach Meters, Air Speed Indicators, Computers, Switches and many other precision-built components.

At Greenleaf Plant No. 2 facilities are available for precision castings.

Gulf announces a

New Aircraft Engine Oil

...proved 5 ways better!



1. **Improves internal engine cleanliness**
2. **Minimizes sludge and oil inlet screen deposits**
3. **Lowers rate of parts replacement due to wear**
4. **Low pour point for ease of starting even under severe winter temperatures**
5. **Increases periods between engine overhauls**

NEW GULF AIRCRAFT ENGINE OIL is available in four S.A.E. grades (30-40-50-60) to provide packaged straight mineral aircraft engine oils for *both* radial and horizontally opposed engines used in commercial service.

You can count on getting trouble-free service from Gulf's new Aircraft Engine Oil. It has been extensively flight service tested in all types of air-cooled engines by private operators, executive fleets and airlines.

These operators report cleaner oil inlet screens, remarkable freedom from piston ring and valve sticking and reduced rocker-box coking. It all adds up to the fact that *Gulf's new high-quality Aircraft Engine Oil gives maximum operating efficiency and increased periods between engine overhauls.*

So the next time your plane is serviced make it new Gulf Aircraft Engine Oil and find out for yourself.

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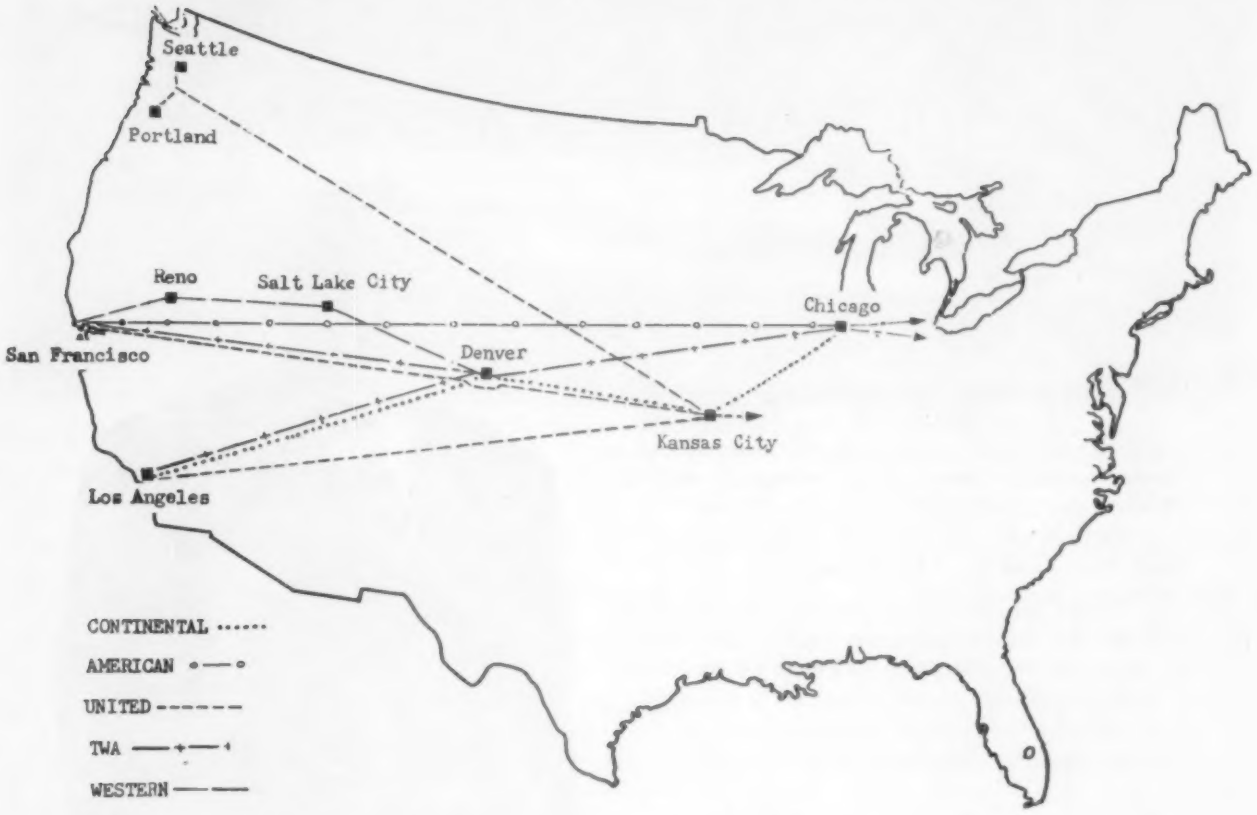
AVIATION PRODUCTS



MAP SHOWS the important new regional and transcontinental routes awarded to five airlines in the Denver service case.

Regional Carriers Win New Western Routes

Washington — Greater competition and a strengthening of western regional carriers are the major factors in the Civil Aeronautics Board Denver service case decision.

The Board went beyond the recommendations of its examiner in the case (AW Aug. 8, p. 99) and added competition between United Air Lines and Trans World Airlines at Denver and Kansas City to the new routes suggested for Continental Air Lines and Western Air Lines in the examiner's report.

Here are the new routes and services awarded:

- **Continental,** a new route between Chicago and Los Angeles via Kansas City and Denver.
- **Western,** a Denver to San Francisco/Oakland route via Salt Lake City and Reno.
- **Denver is added** to Trans World Airlines' transcontinental route.
- **Kansas City is added** to United Air Lines' transcontinental route.
- **American Airlines' route structure** is adjusted to permit nonstop service between Chicago and San Francisco/Oakland.

At the same time, CAB issued a decision supplementary to the New York-Chicago case adding Pittsburgh to United's system. The new United service at Pittsburgh, subject to a long-haul restriction, is designed to improve service between Pittsburgh and points west of Chicago.

Follows CAB Trend

The Board also ordered an investigation to determine whether the present restriction on American, United and TWA against operational stops at points not in their certificates should be lifted.

The routes awarded Continental and Western follow a trend toward strengthening the position of regional carriers which appears to be developing in CAB treatment of the major route cases which are before it this year (AW Oct. 10, p. 115). According to the decision in the Denver case, these route awards were made to improve regional service in the area between Chicago and the West Coast, and they can substantially strengthen the positions of the two small trunklines, especially that of Continental.

The Board estimates that the new route will mean an additional $5,852,000 in revenue and a $200,000 reduction in subsidy for Continental. Western should have a profit of about $1 million on its new Denver-San Francisco route, according to the CAB.

Both carriers are restricted in their new services. Continental's flights between Kansas City and Chicago must originate in Los Angeles, and the carrier cannot operate single plane service between Chicago and points south of Kansas City. Single plane service to points on the new Los Angeles-Chicago route cannot be operated from points south of Denver.

Reverses Examiner

Western is prohibited from operating a through plane service between San Francisco and Reno and points other than Denver which are north or east of Salt Lake City.

CAB reversed the examiner's finding that a Continental-Capital Airlines interchange answers the need for new transcontinental service at Denver and Kansas City. The Board prefers

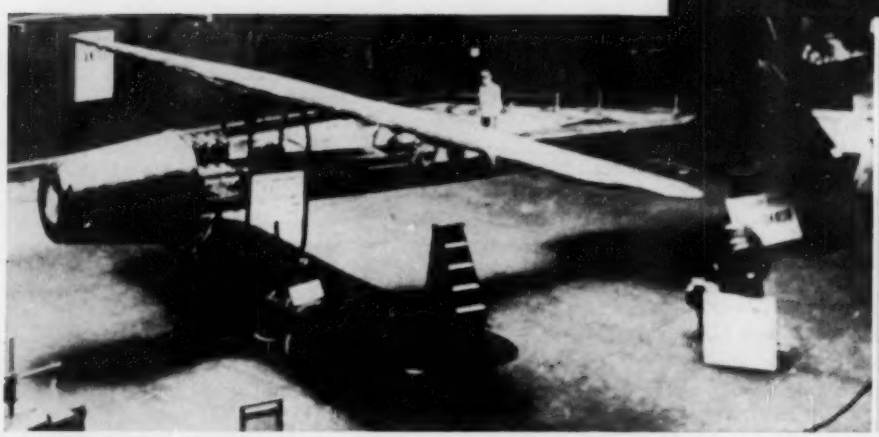
WHAT DO YOU KNOW ABOUT AVIATION...

Who Was the Father of Jet Aviation?

Far back in 1909, a young Frenchman decided that there could be a different type of aircraft other than the then currently accepted "kite" models. Putting his ideas to work, he built a plane powered by a turbo-propulsor, with a fuselage of slender silhouette, a delta-form tail assembly, a retractable landing gear and wings of polished plywood. In April, 1910, his revolutionary plane took off – and flew. The young man's name was – and is – Henri Coanda.

Today his ideas have reached fruition in the modern age of jet transportation. Still active, he typifies the spirit that has kept France to the fore of international aviation . . . the spirit that has enabled Air France to successfully serve the people of 76 countries for 37 years.

Henri Coanda today.



The first Jet aircraft.

The jet turbine of the Coanda motor designed in 1909.

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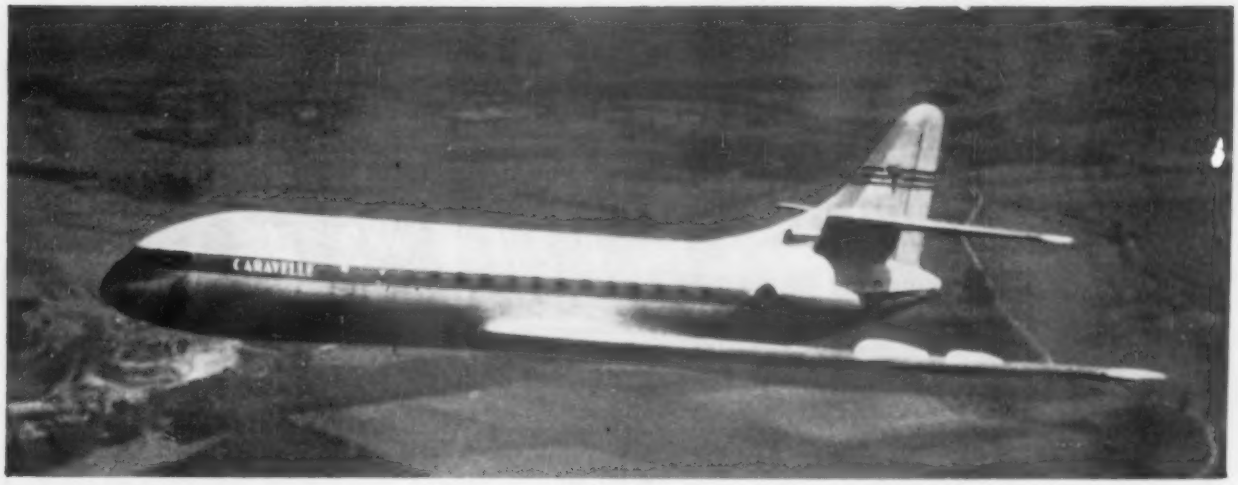

Sncase S.E. 210 Caravelle

Size and shape of wing fences show up clearly in this recent flight photo of Sncase S. E. 210 Caravelle. In 72 flight tests, the Caravelle has flown over 150 hr. Air France is placing an order for 12 of these medium range jet transports for operation on overseas routes of the French Union. Other French carriers, with which Air France recently agreed to share air traffic within the Union, will place orders soon.

adding the points to TWA and United.

The Board said the proposed interchange would be inferior to a single carrier transcontinental service as indicated by schedules submitted by Capital and Continental which would offer "a milk run type of service."

The Board also expressed the fear that the problems of developing new regional service and transcontinental interchange service might result in Continental concentrating on one to the detriment of the other.

Coach Promotion Factor

In choosing TWA and United, the Board said the examiner didn't go far enough in giving Denver a second transcontinental service but was too concerned with protecting the regional carriers.

A major factor in the choice of TWA over American for the new Denver service lies in the fact that TWA is a more vigorous promoter of aircoach services, and the CAB finds that Denver needs better development of its coach potential, especially to such points as New York and Washington.

TWA's authority to serve Denver is restricted so that Denver can't be served on the same flight with Kansas City or St. Louis. Traffic between Denver and Los Angeles and San Francisco is subject to a long-haul restriction.

The CAB finds that Kansas City, like Denver, needs improved transcontinental as well as regional services. Certification of United at Kansas City gives that city its first single plane service to the Pacific Northwest and will offer the first competitive single plane service to San Francisco. United and Continental will be able to offer competitive service from Kansas City to Los Angeles.

United is restricted from serving Kansas City on flights serving Denver or Chicago, protecting Continental and Braniff from traffic diversion.

Competition Need Cited

The CAB discounts the diversion to be suffered by United and TWA from this invasion of points that are historically their private preserves. The Board figures that what United loses to TWA at Denver it will pick up from TWA at Kansas City and vice versa.

The modification of American's certificate to permit nonstop service between Chicago and San Francisco is the result of a CAB finding that the route needs a third competitive nonstop service. Currently, American has to make a stop at Tulsa, Dallas/Ft. Worth or a point farther west.

The Board rejects proposals for American nonstop authority between Los Angeles and various points east of Chicago, particularly Detroit. The Board feels that a Detroit-Los Angeles nonstop service for American would overshadow the recent one-stop authorization for the route given to TWA in the New York-Chicago case.

North American Rejected

As in the New York-Chicago case, CAB rejected the application of North American Airlines for a certificate. In addition to the reasons named in the New York-Chicago case—largely unfitness based on violations of the Civil Aeronautics Act—the CAB details operational factors which led it to turn down the North American bid.

The Board points out that the nonscheduled carrier couldn't supply the through service to eastern points found required for Kansas City and Denver. Also, North American would be more interested in the long-haul business on the western routes and wouldn't provide the proper regional type service, according to CAB. North American has announced it will appeal the Board's decision in court.

CAB Vice Chairman Joseph P. Adams disagreed with the majority treatment of North American. Since basic issues in the case are under court review, he would defer action on the nonscheduled carrier's application until the courts have reached their decisions.

Dissenting Views

A dissent from the majority opinion was filed by members Chan Gurney and Harmar Denny on two issues. They feel that the extension of Continental to Chicago and TWA from Denver to San Francisco "represent illogical and economically unsound route extensions."

According to the dissent, extension of Continental to Chicago offers no substantial improvement of service to the public, and the competition of other stronger carriers on the routes will mean losses to Continental.

Referring to the fact that Continental has been described as a regional-local service carrier, Gurney and Denny pointed out that the carrier is now suddenly converted to a long-haul operator and said "such a metamorphosis cannot be successfully accomplished in one giant step, and it does the small regional carrier a disservice to attempt it."

On the Denver-San Francisco route awarded to TWA and Western, the dissenting members said that there is room for only one of the two carriers, and the route should be awarded to Western.

Capital Airlines

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ACC Group Proposes Integration Of Civil Airways, Air Defense

Washington—An air traffic control concept based on peacetime integration of military air defense equipment and civil airways to form a common navigation system has been proposed to the Air Coordinating Committee by its Special Working Group 13. (A similar proposal was recently made by the technical director of USAF Rome Air Development Center, see AW Nov. 7, p. 17.) Other proposals include:

- **Visual Flight Rules** will not apply in areas where the density of traffic and the speed of aircraft necessitates the use of positive Instrument Flight Rule controls regardless of weather. The SWG-13 report notes that improvements in air traffic control is necessary in these areas before instrument rules can be applied without economic and operational penalties to the users of the system.
- **The Common System concept** must permit development of a traffic control service compatible with all aircraft using the airways and pilot capabilities. This is the first time that a Federal group has recognized the steadily widening gap between the performance capabilities of different classes of aircraft and the proficiency of pilots flying them.
- **Continuation of and interim** traffic control system which would include use of both military and civil radar to expand coverage; use of direct pilot-to-controller voice radio communications; application of improved methods of transferring and displaying control data.
- **Priority is given** to extending radar control to cover large, multiple-airport terminal areas and high density enroute areas. Key to successful early use of long-range radar, the group said, is a combination of a large scale blow-up of a radar display that is bright enough to be used in conjunction with a simplified posting system.
- **Interim relief** of the traffic control problem does not call for new developments since there are now available devices that can be rushed into early use. The interim system should have such advantages as permitting reduced separation of aircraft to break control bottlenecks; greater flexibility in routing which will provide the required capability of area traffic control; efficient integration of jet traffic with conventional piston powered aircraft.

The group was particularly careful in its recommendations regarding different classes of aircraft and pilot capabilities. The report said the revised Common System must consider the need of different users by providing:

- **A segment of the overall airspace** designed to handle users with minimum equipment;
- **A segment of the airspace to provide** separation for the fully equipped user;
- **Separate airports** for different categories of traffic in areas of high density.

The final decision on the SWG-13 report is dependent on the reaction of NAV-Panel of the ACC. The panel has until Dec. 5 to evaluate the report. The group was headed by Sam Saint, a former American Airlines pilot now on the Air Navigation Development Board.

Two basic facts were accepted by the group before they investigated air traffic control:

- **Needed improvements** in air traffic control are not being developed and adopted quickly enough to keep pace with the increasing demands of the system.
- **An unfavorable balance** between the demands on the system and operational capability exists.

Specific operational limitations, the report said, include:

- **Delay and disruption** to operations exceed tolerable limits, in spite of major improvements made in air traffic control over the last few years.
- **Essential military operations** are suffering interference where training, tactical and other missions must be accommodated by the Common System.
- **The present Common System** is not capable of handling in a satisfactory manner the steadily increasing military jet traffic and integrating the traffic with the aircraft operating at the lower altitudes.
- **Means for integrating high density** helicopter operations with other types of traffic have not been developed.
- **Air space is used** inefficiently in the present control operation, with the exception of those limited areas where radar control is now in effect.
- **Sharp decreases** in system capacity result when an unanticipated change in traffic flow is caused by a change in the weather or other circumstances.

SAS to Order U.S. Jets For Transpolar Route

Los Angeles—Tore H. Nilert, president of Scandinavian Airlines Systems, Inc., announced last week that the airline will soon announce an order for jet transports. They will be placed in service on its transpolar route in 1960.

SAS holds space on jet assembly lines of both Boeing Airplane Co. and Douglas Aircraft Co. but is expected to make its decision in favor of the Douglas DC-8.

The Scandinavian airline has 14 Douglas DC-7Cs on order which will be placed in service on the Los Angeles-Copenhagen route next year, cutting the present flight time by nearly seven hours. Jet transports will reduce it by six more, Nilert said.

Nilert also reported that since SAS polar flights were begun a year ago, load factors on the polar route have averaged 73% in both directions. The operation was in the black after only six months, he said.

SAS plans to begin daily flights over the polar route by next summer and also will continue the tourist service inaugurated in the last month. Nilert reported 100% completion of all flights on the route with better than 90% on-time arrivals in Los Angeles and Copenhagen.

CAB to Investigate Interline Agreements

Civil Aeronautics Board has ordered an investigation to determine whether interline agreements should be encouraged between the domestic segments of U.S. carriers and foreign carriers which are not members of International Air Transport Assn.

The investigation resulted from a case involving National Airlines and Transportes Aereos Nacionales of Honduras. National cancelled an interline agreement for through passage over its domestic segment and TAN, presumably on the grounds that the resultant combination fares were below minimums established under IATA resolutions. TAN objected to the Board that IATA minimum fares "cannot properly be interpreted as covering the combination of a fare for a domestic segment with a non-IATA foreign carrier's fares . . ."

Since most U.S. domestic operations are by IATA members, CAB warned that IATA resolutions "may effectively restrict the opportunity of non-IATA carriers to serve non-gateway points in the U.S. by combination over domestic segments" and ordered an investigation as to whether this is in the public interest.

Mexicana Buys DC-7Cs

Mexicana de Aviacion, affiliate of Pan American World Airways, last week announced the purchase of four DC-7C 60-passenger transports from Douglas Aircraft Co. for delivery during 1957 and 1958

Airline officials say the new planes will reduce the flying time on its Los Angeles-Mexico City route by an hour.

HERE ARE FACTS WHY

DME IS A SAFE INVESTMENT

There has been so much smoke and confusion about future navigation systems that the airspace is apt to be filled with ideas instead of navigation signals.

The situation has understandably bewildered aircraft owners and given them cause to wait and see—even though they realize that a navigation system which gives them both distance (rho) and bearing (theta) would greatly simplify their cross-country navigation and IFR operations.

These facts are now clear and cannot be disputed:

1. The VOR/DME system is fully developed providing highly dependable and extensive service. Congress has appropriated funds for continuation of this system. There are 231 DME's in operation now and 175 more on site ready to be turned on when additional funds become available.

2. CAA, in its 5 year navigation program proposal just made public, calls for 393 more VOR's and 648 additional DME's.

3. The Air Coordinating Committee, whose recommendations generally set National Air Policy, has assured DME operation for years to come. ANDB's decision earlier this year was not to *adopt* Tacan, merely to investigate its possible use in the Common System.

4. Tacan is still in a very experimental stage as a common system element. In its present form it is strictly a tactical navigation equipment. Conservative estimates say that four years would be required to re-engineer ground equipment for satisfactory civil airway use. No satisfactory design for airline or small aircraft Tacan has been demonstrated. Tacan does not provide voice communication or ILS approaches and these functions would require separate equipment if Tacan were adopted in its present form.

5. Implementation of such a system on the airways to the same level of operation as VOR/DME today would require eight to ten years. This has been confirmed by CAA, ANDB and IATA.

6. There is no argument in any quarter as to the reliability, accuracy, or dependability of present-day DME. It is recognized by all as being equally accurate as any other distance measuring system. It has been completely "de-bugged" and backed by a nation-wide service.

7. New, authorized DME approach procedures are already being published in the Airman's Guide and are being incorporated in the Jeppesen Manual as fast as released. These DME approaches permit lower minimums in many cases where terrain clearance has been a problem, reduce to a minimum let-down procedures, greatly expedite instrument operations. Australia has made DME mandatory for airline operations and pilots report DME far more accurate than older systems of using cross-bearings and even fan markers for position indication.

8. The conclusion which can be drawn by any clear-thinking aircraft user is that:

- **No other system can possibly supersede DME for a decade.**
- **VOR/DME provides *today* and in the years to come a highly superior navigation system with continuous position indication without estimate, calculation or guess-work.**
- **Highly reliable, light-weight airborne DME is available today.**
- **Anyone installing DME in his aircraft can be assured beyond any question of doubt of getting a full span of usefulness out of his DME with no danger of rapid obsolescence.**

If you would like more information on Narco Model UD 1-1A DME see your nearest Narco distributor, factory-approved service center or write to National Aeronautical Corp., Ambler, Pa.

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Rizley Proposes Board Reforms

Civil Aeronautics Board Chairman Ross Rizley has proposed a number of changes and reforms for his agency in his first major speech since he took office last March.

Rizley called for a return to the basic principle of public need in dealing with route cases and other CAB matters in a speech at Enid, Okla.

Here are Rizley's recommendations:

- **Revision of the Civil Aeronautics Act** to restrict the Ashbacker doctrine (AW Nov. 7, p. 110).
- **Amendment of the Act** to permit questions of fitness, willingness and ability to be determined separately from cases involving questions of public need.
- **Reexamination of the Act** to bring a sharper focus on the public convenience and necessity in fact as well as theory.
- **Familiarization of Board** and staff members with actual operations of the airline industry.
- **Closer collaboration** between Government and industry in negotiation of bilateral agreements.
- **An annual assembly** of industry representatives to meet with the Board to discuss current aviation problems.

Rizley said that the true issue of public convenience and necessity tends to become subordinated to arguments over which carrier should perform new services.

The chairman favors revision of the Ashbacker doctrine because by emphasizing the private rights of carriers, it de-emphasizes the public need for new service and tends to make cases so large and unwieldly that "it becomes impossible to arrive at a fully reasoned and integrated decision."

In the long run, the effect of this is to give an advantage to the larger carriers which can better afford to prosecute a drawn-out proceeding, according to Rizley.

Rizley also criticized the industry and Congress for the extrajudicial pressures brought on the Board to favor specific points of view in considering decisions. He said the pressures are bad for both sides, since the Board is constantly harassed and may overreact to them.

Rizley suggested an educational program which would include visits by the CAB staff to airline installations. He defended the policy of using free airline transportation to accomplish this in view of CAB travel budget limitations.

A second educational suggestion was that an industry advisor be included on the U. S. negotiating teams which make bilateral agreements with other governments. He also suggested that industry representatives and others associated with aviation form an Advisory Assembly on Aviation to confer with the Board on general aviation issues.

Seaboard Proposes New Financing Plan

Seaboard and Western Airlines proposes to turn its equipment financing over to a newly-organized firm, Air-World Leases, formed by principals of North American Airlines, and has requested approval of Civil Aeronautics Board.

Fifty per cent of Air-World's stock is divided equally (12.5% each) among these four officials of North American: Stanley Weiss, James Fischgrund, Jack Lewin, Roscoe R. Hart. The other 50% stock is held by Intercontinental Financial Corp.

Seaboard's application to CAB proposed that Air-World purchase two DC-4s from Seaboard for $1.3 million and acquire Seaboard's contract with Lockheed Aircraft Corp. for Super Constellation aircraft. Seaboard would lease the DC-4s for four years, with option to buy, and would lease the Constellations for seven years, with option to buy.

F.B.I. Says Sabotage Behind United Crash

U.S. airlines last week found themselves confronted by an incident they had long feared—the successful sabotage of an American airliner.

There had been aborted attempts (i.e., in Los Angeles five years ago), but 23-year-old John Gilbert Graham was the first to actually send a U.S. airliner down in flames with a crudely-fashioned timebomb. The crash of the United Air Lines plane outside Denver on Nov. 1, took the lives of all 44 persons aboard. Graham's motive: to collect a $37,500 travel insurance policy he had taken out on his mother, one of the victims.

The crash and Graham's subsequent arrest highlighted the airline industry's lack of any real method (other than visual) of screening baggage and cargo. Immediately after the arrest, Civil Aeronautics Administrator Fred B. Lee went into conference with F.B.I. director J. Edgar Hoover to discuss "various types of preventive action . . . to detect explosives concealed in luggage," but there was little likelihood that any would be found within the immediate future.

Probably the best deterrent will be Graham's speedy arrest and the possibility of a just-as-speedy conviction.

Civil DME by Collins

Collins Radio Co. will market a civil DME set designed to work with the present Civil Aeronautics Administration ground stations. The announcement is another straw in the wind that the battle between Tacan and civil DME may be swinging in favor of the civil system. (See page 61). The set will be developed to Collins specs by Narco, one of two manufacturers now producing civil DME equipments.

KLM Orders DC-8s

KLM Royal Dutch Airlines ordered eight Douglas DC-8s last week to become the first foreign carrier to conclude a firm contract for American turbojet transports. Value of the order, including spares, is $52.5 million. Deliveries are to begin in March, 1960.

KLM says that the aircraft will be powered by Pratt & Whitney engines, presumably the J-75. However, any mention of this engine officially by Pratt & Whitney is barred by military security. Douglas consequently has been investigating foreign engines as a safeguard against either unavailability of the J-75 or unsatisfactory performance data when J-75 details can be revealed to the airlines.

Among engines which Douglas probably has considered are the Rolls-Royce Conway and the Bristol Olympus.

First route on which KLM will operate DC-8s is the Atlantic. Travel time between New York and Amsterdam will be cut to six and one-half hours from the present schedule of 13 hours and to eight and one-half hours westbound.

Gross takeoff weight of KLM's jets will be 257,000 lb., with a payload of 34,000 lb.

TWA Places Order For Eight Super Gs

Trans World Airlines last week announced an order for eight additional Lockheed Super G Constellations with deliveries beginning next June.

TWA first placed Super G airliners on its transcontinental routes last April and has 20 of the aircraft in service at the present.

Its total of Super and Standard Constellations stands at 101.

The delivery of the eight new Super Gs will precede that of the previously announced $70 million order for 24 1649 Super Constellations (AW April 25, p. 117) which is scheduled to begin in early 1957.

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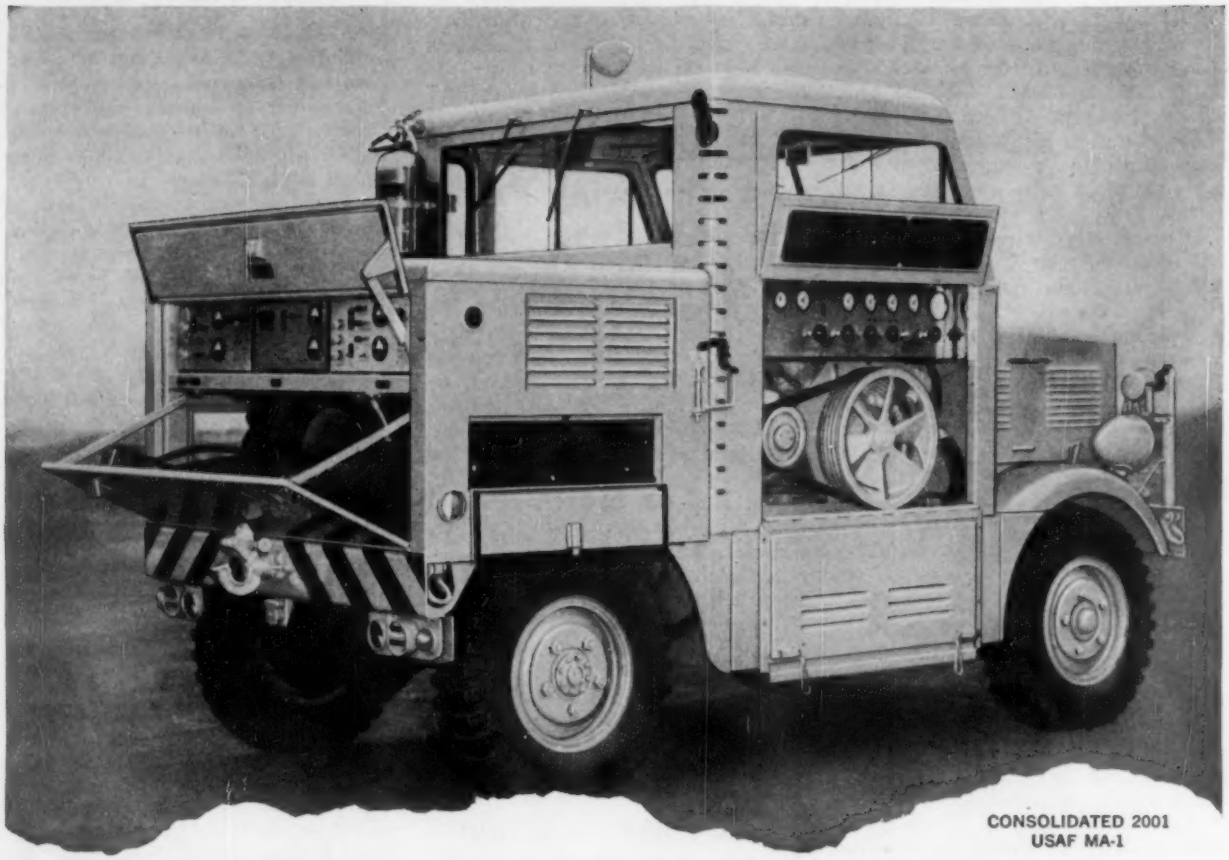

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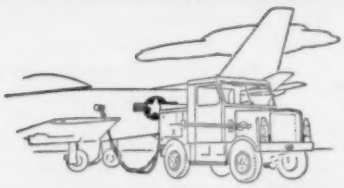

To meet the vital jet age needs of ground support, Consolidated has devoted its fullest resources developing both single and multi-purpose units . . . proven efficient . . and now in active service. Typical of these units is the Consolidated Model 2001 (U.S.A.F. MA-1). This highly compact self-propelled vehicle combines in a single unit all requirements for towing, testing, servicing and starting jet aircraft.

It provides

- **A. C. POWER . . . 30 KVA, 400 cycles, 3 phase and 10 KW 1 phase, close regulated.**
- **D. C. POWER . . . 28.5 volts, up to 2250 AMP. For Split or single bus start and servicing.**
- **COMPRESSOR . . . Air supply up to 3500 psi, 13.5 CFM, 1,000 cu. in. reservoir.**
- **TOWING . . . All-wheel drive vehicle with mechanical or torque converter transmission, as desired.**

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Airline Revenues—August, 1955

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Federal Subsidy	Total Operative Revenue	Total Oper. Expenses	Net Oper. Income (before taxes)
DOMESTIC TRUNK								
American Airlines	20,341,541	508,299	415,915	1,287,725	.....	22,790,598	18,888,283	3,902,315
Braniff Airways	3,031,503	74,087	48,915	95,888	.....	3,316,406	3,033,173	283,233
Capital Airlines	4,250,339	95,039	110,858	98,589	.....	4,643,707	4,480,909	162,978
Colonial Airlines	676,701	41,638	3,505	14,434	.....	745,895	700,431	45,463
Continental Air Lines	1,296,502	30,263	10,788	37,282	71,291	1,490,152	1,396,974	93,177
Delta Air Lines	4,159,567	107,840	85,276	151,909	.....	4,590,162	4,069,806	520,356
Eastern Air Lines	13,075,023	274,480	193,972	224,479	.....	14,158,461	13,296,867	861,594
National Airlines	2,819,081	66,097	20,983	76,420	.....	3,126,253	2,905,062	221,191
Northeast Airlines	1,097,625	7,344	9,510	21,955	40,650	1,196,060	1,002,494	193,566
Northwest Airlines	4,813,448	146,564	82,689	170,250	.....	5,287,293	4,073,702	1,213,590
Trans World Airlines	13,367,869	342,010	300,524	452,626	.....	14,699,287	13,355,487	1,343,800
United Air Lines	20,983,320	699,120	429,300	904,619	.....	23,134,206	18,664,669	5,012,364
Western Air Lines	2,868,222	69,074	32,090	59,819	.....	3,063,943	2,344,394	719,548
INTERNATIONAL								
American Airlines	436,186	14,490	308	44,317	.....	511,735	363,223	148,512
Braniff Airways	513,833	112,329	.....	26,844	.....	686,719	709,000	22,281
Caribbean Atlantic Airlines	97,536	1,021	.....	3,703	315	108,709	101,553	7,156
Colonial Airlines	136,230	4,997	.....	1,190	.....	146,296	132,467	14,459
Delta Air Lines	408,284	4,759	.....	806	.....	445,171	409,244	35,927
Eastern Air Lines	824,468	18,602	.....	17,944	.....	984,197	795,637	188,560
National Airlines	306,314	3,352	1,810	12,306	.....	329,616	309,942	19,674
Northwest Airlines	1,316,450	458,056	5,780	191,302	.....	1,995,906	1,897,326	98,579
Pan American World Airways								
Alaska	509,000	17,000	.....	90,000	116,000	823,000	670,000	153,000
Atlantic	8,969,000	681,000	.....	554,000	230,000	10,824,000	8,780,000	2,044,000
Latin America	5,251,000	251,000	.....	730,000	222,000	6,810,000	6,034,000	776,000
Pacific	4,272,000	610,000	.....	394,000	.....	5,408,000	4,803,000	605,000
Pan American-Grace Airways	1,229,968	123,269	.....	77,956	4,023	1,518,017	1,507,151	10,865
Trans World Airlines	5,503,763	531,952	.....	300,912	.....	6,559,766	5,261,423	1,298,343
United Air Lines	1,395,835	33,072	.....	15,384	.....	1,447,396	760,320	455,019
LOCAL SERVICE								
Allegheny Airlines	396,020	10,434	10,584	.....	132,513	554,567	571,512	−16,945
Bonanza Air Lines	128,681	3,324	1,273	2,690	83,056	228,104	219,796	8,307
Central Airlines	66,686	8,448	892	3,008	157,154	237,425	245,748	−8,323
Frontier Airlines	258,584	249,304	3,071	19,995	.....	535,792	478,591	57,201
Lake Central Airlines	110,056	7,687	7,012	.....	112,422	239,855	235,556	4,298
Mohawk Airlines	297,972	3,578	2,476	4,574	38,700	355,042	384,374	−29,331
North Central Airlines	560,968	20,396	12,355	.....	69,390	668,392	627,231	41,161
Ozark Air Lines	214,064	139,948	6,282	.....	.....	364,614	388,613	−23,999
Piedmont Aviation	398,230	7,235	5,583	7,629	129,930	567,419	582,318	−14,899
Southern Airways	146,623	151,464	4,918	.....	.....	306,021	302,122	4,665
Southwest Airways	284,926	8,377	3,388	4,522	79,860	421,917	361,127	60,790
Trans Texas Airways	181,220	15,057	2,667	6,072	206,058	414,201	387,238	26,963
West Coast Airlines	204,067	4,884	1,354	3,879	148,313	366,168	325,912	40,255
HAWAIIAN CARRIERS								
Hawaiian Airlines	446,874	2,685	.....	67,443	27,462	548,974	467,940	81,034
Trans Pacific Airlines	207,447	694	.....	8,345	4,392	221,066	187,478	33,587
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	141,008	.....	145,072	149,020	−4,178
Flying Tiger Line	.....	.....	.....	636,267	.....	1,033,310	881,062	152,248
Slick Airways (not available)								
Riddle Airlines	.....	50	.....	155,501	.....	297,227	239,811	57,416
HELICOPTER SERVICE								
N. Y. Airways	17,077	2,673	2,848	1,849	119,626	164,729	134,557	30,172
Los Angeles Airways	3,663	12,427	5,054	.....	72,791	94,309	78,073	16,235
Helicopter Air Service	.....	45,721	.....	.....	.....	46,038	43,166	2,871

Compiled by AVIATION WEEK from airline reports to Civil Aeronautics Board.

BOEING B-47, 6-JET BOMBER, at the Georgia Division, Lockheed Aircraft Corp., Marietta, Georgia, serviced by G-E Frequency Changer Package that supplies ground power for testing of electrical control and equipment for radar, radio, and electrical systems.

LOCKHEED AIRCRAFT CORPORATION REPORTS . . .

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GENERAL ELECTRIC

CAB ORDERS

GRANTED:

Capital Airlines an exemption to provide free transportation to technical representatives of Vickers-Armstrongs, Ltd. and Rolls-Royce Ltd.

Leave to intervene in the North Central-Lake Central acquisition case to Detroit and Detroit Chamber of Commerce.

North Central Airlines permission to serve Chicago's O'Hare Airport. North Central is denied authority to serve O'Hare and Midway Airport on the same flight.

Caribbean Atlantic Airlines permission to serve Ponce, Puerto Rico.

Pan American World Airways an exemption to perform two direct roundtrip flights between Honolulu and Tafuna, American Samoa, in addition to its scheduled South Pacific services via Canton Island.

Leave to intervene in the case involving restrictions on Northwest Airlines turnaround service between Detroit and Cleveland and Pittsburgh to Capital Airlines, Eastern Air Lines, Trans World Airlines and United Air Lines.

APPROVED:

Mohawk Airlines' loan-purchase with Northeast Airlines relating to purchase of a Convair 240 from Northeast.

Agreements involving Trans World Airlines, Braniff Airways and various other carriers relating to intercompany arrangements.

Interlocking relationships between Peter Bernacki, Helen Bernacki, Peter A. Bernacki, Inc., and Cross-World Travel Agency.

Appointment of Robert W. Clifford and Eugene S. Duffield to the board of directors of Lake Central Airlines.

ORDERED:

Interested parties allowed to present factual material and oral argument on the issue of service between Fort Smith, Ark., and St. Louis, Mo., by Central Airlines or Ozark Air Lines.

Temporary rates for transportation of surface mail in the eastern U. S. set at the rates proposed by the Board in show cause order for the period starting Oct. 1.

Trans-Texas Airways authorized to suspend service at Coleman, Tex., until airport facilities at that point are adequate for service by the carrier.

Bonanza Air Lines' certificate made permanent, effective Jan. 3, 1956, in the form proposed by the Board.

Bonanza Air Lines' temporary authority to suspend or omit service at certain points extended for an indefinite period.

Braniff Airways' mail rates for domestic operations set at the rates proposed by the Board in its show cause order for the period starting Dec. 31, 1954.

Modification of a previous Board order approving an International Air Transport Assn. agreement to omit language inadvertently included.

Braniff Airways' mail rates for international operations set at the rates proposed by the Board in its show cause order for the period starting Dec. 31, 1954.

DENIED:

North Central Airlines' application for temporary exemption to provide air service between Midway and O'Hare Airports.

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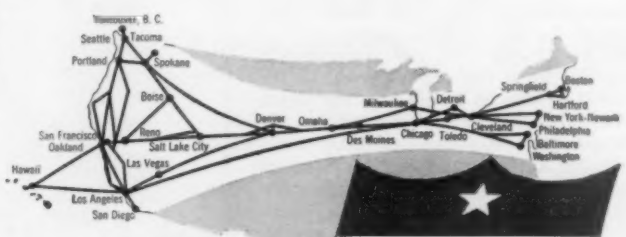

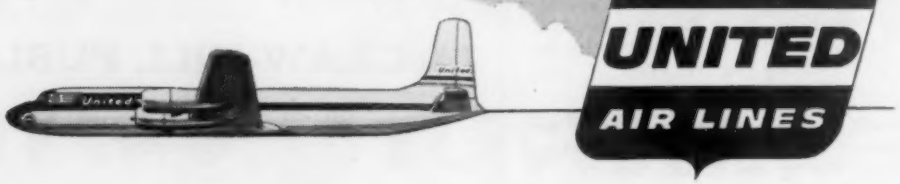

Capital Promotes Theatre Charters

Washington—Capital Airlines has started a novel promotion campaign with a theatre airlift. Capital carried three plane-loads of theatre-goers from Pittsburgh to New York in a Show Plane package deal that included four Broadway shows and other entertainment.

The airline is joining local theatre groups and newspapers in a campaign to tap markets which have been successfully promoted by the railroads in the past.

According to Capital's assistant sales promotion manager, Hugh Jacox, the first theatre trip was well received, and the airline plans a year-round program of trips from points outside the New York area.

The first Show Plane was a $89.13 package trip in early October offered by Capital in conjunction with the Pittsburgh Post-Gazette and the Council of the Living Theatre. The 180-passenger limit was subscribed early in the promotion campaign, and 250 applications had to be returned.

View Four Shows

For the $89.13 fare, the Pittsburgh subscriber got three days in New York with all expenses paid except meals. Included in the package were orchestra seats to four Broadway shows chosen by the drama critic of the Post-Gazette, saving the passenger a brush with the inevitable ticket scalper often encountered by visitors to New York.

The theatre airlift—three DC-4s—left Pittsburgh at noon Monday. Passengers lunched on the airplane, and checked into the Statler Hotel on arrival in New York. They attended a cocktail party Monday evening to get acquainted with each other and meet stars of some of the shows they were to see. Later, they attended "Cat on a Hot Tin Roof."

The Tuesday program featured a special luncheon at Sardi's, a theatrical restaurant, and say "Plain and Fancy" in the evening.

On Wednesday, the Pittsburghers saw a matinee of "Damn Yankees", checked out of the hotel, then went to an evening performance of "Witness for the Prosecution" while Capital transferred their luggage to the airport for the return trip to Pittsburgh. About a third of the group decided to delay their return home, which they could do under the terms of the Show Plane package.

Plan Future Trips

Between the scheduled events, the Pittsburgh group was on its own for meals, sightseeing and any other entertainment.

Capital ran the trip as a cost operation, figuring the profit lies in the promotion for the airline. The carrier made all arrangements for transportation, hotels and the program of events.

Reaction from participants in the theatre trip has been very good, according to Capital, and plans are being made for future trips. The weekday flights help Capital during the slack days of the week, and the theatre operators like them for the same reason. Theatre people also look forward to the trips as stimulants for business during the normally slack summer season.

The next trip is scheduled for early December from Canton and Akron, Ohio, in conjunction with the Canton Players Guild, and Capital is working on a trip from Flint, Mich., in January.

SHORTLINES

▶ **Air Transport Assn.** reports U.S. scheduled airlines flew 252,454,000 revenue ton-miles in September, an increase of 17.22% over September, 1954. Traffic for the first nine months of this year was 2,133,117,000 revenue ton-miles, 19.47% more than the same period last year . . . Passenger fatality rate for the year ending October, 1955 was .62 per 100 million passenger-miles. Domestic rate was .74 and the international rate .05.

▶ **British European Airways** reports a 25% increase in traffic last summer. In the year ending Sept. 30, 1955, BEA carried 2,100,000 passengers 667,500,000 passenger-miles at load factor of 70.4%.

▶ **Flying Tiger Line** flew 6,301,635 ton-miles of traffic in October, an increase of 92% over the previous October. FTL operated 47,997,435 ton-miles in the first ten months of the year, 57% more than the same period of 1954.

▶ **Qantas Empire Airways** has introduced tourist fares to its Sidney-Johannesburg services with combination class Super Constellations. Flights leave Sidney and Johannesburg every other week.

▶ **Seaboard and Western Airlines** flew 10,911,000 freight ton-miles in the first ten months of this year, a 45% gain over the same period last year.

▶ **United Air Lines** reports record traffic of 362,740,000 passenger-miles for October, a 16% increase over October, 1945, traffic.

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AVIATION WEEK—NOVEMBER 21, 1955

ADAMS RITE MFG. COMPANY 88
Agency—Byron H. Brown & Staff, Inc.

ADEL PRECISION PRODUCTS, A DIV. OF GENERAL METALS CORP. 42
Agency—The McCarty Company

AERO SUPPLY MANUFACTURING CO. 86

AEROJET-GENERAL CORPORATION 43
Agency—D'Arcy Adv. Company

AIR FRANCE 100
Agency—Buchanan & Company, Inc.

AIRCOOLED MOTORS, INC. 77
Agency—Richards & Webb, Inc.

AIRWORK CORPORATION 113
Agency—Gene Wyble Adv.

AMERICAN ELECTRIC MOTORS, DIVISION OF AMERICAN ELECTRONICS, INC. 67
Agency—Clyde D. Graham Adv.

ARO EQUIPMENT CORP, THE (AIRCRAFT PRODUCTS DIV.) 74
Agency—Beeson-Reichert, Inc.

AVCO DEFENSE & INDUSTRIAL PRODUCTS, AVCO MANUFACTURERS CORP. 58, 59
Agency—Benton & Bowles, Inc.

AXELSON MFG. CO., DIV. OF U. S. INDUSTRIES, INC. 96
Agency—Charles Bowes Adv.

BEECH AIRCRAFT CORP. 46
Agency—Associated Advertising Agency, Inc.

CALTECH JET PROPULSION LABORATORY 45, 69
Agency—The Perrett Co.

CHANDLER-EVANS DIV., NILES-BEMENT-POND CO. 49
Agency—Hugh H. Graham & Assoc.

CONSOLIDATED DIESEL ELECTRIC CORP. 106
Agency—DeGarmo, Inc.

CONVAIR, A DIV. OF GENERAL DYNAMICS CORP. ..... Front Cover
Agency—Buchanan & Co., Inc.

CONVAIR, A DIV. OF GENERAL DYNAMICS CORP. 84
Agency—Thomas L. Yates Adv.

CURTISS WRIGHT CORP. 40
Agency—Burke, Dowling, Adams, Inc.

DAVIES LABORATORIES, INC. 33
Agency—The Harry P. Bridge Co.

DEAN & BENSON RESEARCH, INC. 28
Agency—John Phillips Adv.

DELAVAN MANUFACTURING COMPANY 48
Agency—Fairall & Company

DOUGLAS AIRCRAFT CO., INC. 80
Agency—J. Walter Thompson Co.

EDO CORPORATION 30
Agency—Davis, Parsons & Strohmeier, Inc.

ELASTIC STOP NUT CORP. OF AMERICA ..... Fourth Cover
Agency—G. M. Basford Company

ELECTRICAL ENGINEERING & MFG. CORP. 19
Agency—West-Marquis, Inc.

FARNSWORTH ELECTRONICS DIV. (INTERNATIONAL TELEPHONE & TELEGRAPHIC CORP. 31
Agency—Chamberlain-Junk Adv. Inc.

FAIRCHILD ENGINE & AIRPLANE CORP. 72, 111
Agency—Gaynor, Colman Prentis & Varley, Inc.

GENERAL ELECTRIC COMPANY 62, 63, 108
Agency—G. M. Basford Company

GENERAL LABORATORY ASSOCIATES, INC. 73
Agency—Riger & Sheehy Adv.

GILFILLAN BROTHERS 20
Agency—Erwin, Wasey & Co., Ltd.

GOODYEAR AIRCRAFT CORP. 29
Agency—Kudner Agency, Inc.

GREENLEAF MFG. COMPANY, THE 97
Agency—Oakleigh R. French & Associates, Inc.

GRUMMAN AIRCRAFT ENGINEERING CORP. 39
Agency—Fuller & Smith & Ross, Inc.

GULF OIL CORPORATION 98
Agency—Young & Rubicam, Inc.

HARRISON RADIATOR DIV., GENERAL MOTORS CORP. 85
Agency—D. P. Brother & Co., Adv.

HOLLEY CARBURETOR CO. ..... Second Cover
Agency—Holden-Chapin-Larue, Inc.

HYDRO-AIRE, INC. 64
Agency—Roy S. Durstine, Inc.

INLAND TESTING LABORATORIES 41
Agency—Merrill, McEnroe & Associates

JOHNS-MANVILLE PRODUCTS 60
Agency—J. Walter Thompson Co.

KAMAN AIRCRAFT CORP., THE 50
Agency—Charles Palm & Co.

KAWNEER COMPANY, THE (AIRCRAFT PRODUCTS DIV.) 51
Agency—Fuller & Smith & Ross, Inc.

KIDDE & CO., INC., WALTER 3
Agency—Cunningham & Walsh, Inc.

KOLLSMAN INSTRUMENT CORP., SUBSIDIARY OF STANDARD COIL PRODUCTS CO., INC. 36
Agency—Schaefer & Favre Adv.

LEAR, INC. (ROME C DIV.) 27
Agency—Buchanan & Co., Inc.

LOCKHEED AIRCRAFT CORP. 78
Agency—Donahue & Coe, Inc.

LORD MANUFACTURING COMPANY 44
Agency—The Jayme Organization, Inc.

LUND AVIATION, INC. 45
Agency—Gene Wyble Adv.

MARQUARDT AIRCRAFT COMPANY 82
Agency—Doyle, Kitchen & McCormick, Inc.

MB MFG. CO., THE, A DIV. OF TEXTRON AMERICAN, INC. 54
Agency—Marsteller, Rickard, Gebhardt and Reed, Inc.

MICOLOC DIV. STILLMAN RUBBER CO. 80
Agency—Lynn-Western, Inc.

MICRO SWITCH DIV. OF MINNEAPOLIS-HONEYWELL REGULATOR CO. 57
Agency—Reincke, Meyer & Finn, Inc.

MINNEAPOLIS HONEYWELL REGULATOR CO. (AERONAUTICAL DIV.) 70, 71
Agency—Foote, Cone & Belding

MONOGRAM MFG. CO., A DIV. OF INTERNATIONAL GLASS CORP. 6
Agency—Taggart & Young Adv.

NATIONAL AERONAUTICAL CORP. 104
Agency—Davis, Parsons & Strohmeier, Inc.

NAPIER & SON LIMITED, D. 38
Agency—C. R. Casson Limited

NEW DEPARTURE DIV., GENERAL MOTORS CORP. 6
Agency—D. P. Brother & Co., Inc.

OLIN MATHIESON CHEMICAL CORP. 82
Agency—Doyle, Kitchen & McCormick, Inc.

PHILLIPS PETROLEUM CO. (AVIATION DIV.) 4
Agency—Lambert & Feasley, Inc.

PIONEER CENTRAL DIV. BENDIX AVIATION CORP. 65
Agency—MacManus, John & Adams, Inc.

REACTION MOTORS, INC. 82
Agency—Doyle, Kitchen & McCormick, Inc.

REEVES INSTRUMENT CORPORATION 112
Agency—Robotham & Peck, Inc.

REM-CRU TITANIUM, INC. 10
Agency—G. M. Basford Co.

ROBINSON CO., RALPH C. 41
Agency—Chapin-Damm Adv.

ROLLS-ROYCE LTD. 102
Agency—The Wesley Associates

RYERSON & SON, INC., JOSEPH T. 111
Agency—Aubrey, Finlay, Morley & Hodgson, Inc.

SAFEWAY HEAT ELEMENTS, INC. 81
Agency—G. F. Sweet & Co., Inc.

SCOVILL MFG. CO. (AIRCRAFT FASTENER DIV.) 79
Agency—Needham, Louis and Brorby, Inc.

SEARCHLIGHT SECTION 86, 87, 88, 89, 90, 91, 92, 93, 94, 95

SENSENICH CORP. 25
Agency—Foltz-Wessinger, Inc.

SOCONY MOBIL OIL CO., INC. 24
Agency—Compton Advertising, Inc.

SOUTHWEST AIRMOTIVE COMPANY 53
Agency—Don L. Baxter, Inc.

SPENCER THERMOSTAT DIV., METALS & CONTROLS CORP. 47
Agency—Sutherland-Abbott Adv.

SPERRY GYROSCOPE CO., DIVISION OF SPERRY RAND CORP. ..... Third Cover
Agency—Reach, Yates & Mattoon, Inc.

SPERRY GYROSCOPE CO., DIVISION OF SPERRY RAND CORP. 83
Agency—Equity Advertising Agency

STEEL PRODUCTS ENGINEERING CO. 32
Agency—Geyer Advertising, Inc.

TEMCO AIRCRAFT CORP. 66
Agency—McCann-Erickson, Inc.

TEXAS INSTRUMENTS, INC. 76
Agency—Don L. Baxter, Inc.

UNITED AIRCRAFT PRODUCTS, INC. 58
Agency—Weber, Geiger & Kalat, Inc.

UNITED AIR LINES 110
Agency—N. W. Ayer & Son, Inc.

WARREN WIRE COMPANY 52
Agency—Jules L. Klein Adv.

WHIRLPOOL-SEEGER CORP. (LAPORTE AIRCRAFT DIV.) 56
Agency—Netedu Advertising, Inc.

WHITTAKER CO., LTD., W. R. 75, 88
Agency—Mogge-Privett, Inc.

CLASSIFIED ADVERTISING
F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES 96-94
SPECIAL SERVICES TO THE INDUSTRY 95
PLANES—EQUIPMENT (Used or Surplus New) For Sale 95
WANTED Planes-Equipment 95

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EDITORIAL

Radioactive Role for Civil Air Patrol

Less than 45 minutes after the 35 kiloton nuclear blast of Operation Cue shattered the desert dawn of Yucca Flat last spring, a maroon Stinson piloted by William Stead, operations officer of the Nevada Civil Air Patrol, flew low altitude precision passes over the radioactive ruins of the ghost town built for Civil Defense tests. Aboard Stead's Stinson were two technicians manning radiation detection instruments to measure the intensity and scope of the atomic blast's after effects. This was the first use of a civilian aircraft on a radiological survey mission. Its success opened a new and vital role for the Civil Air Patrol.

Oak Ridge Search

A few months ago officials of the Atomic Energy Commission's Oak Ridge National Laboratory conducted another test in which Civil Air Patrol planes were given the job of detecting a live radioactive target secreted within a 12-mile radius of the laboratory. With 20 CAP lightplanes participating, each carrying an Atomic Energy Commission technician manning airborne radiological survey instruments, the target was located, its level and perimeter of radiation measured and the information transmitted to ground crews who marked and isolated the contaminated area.

All of this was done in less than 35 hours total flying time by the CAP fleet.

After the Oak Ridge test Dr. K. Z. Morgan, director of the Health Physics Division at Oak Ridge, said:

"I am convinced that air survey by organizations such as the Civil Air Patrol is the only practical way of locating rapidly large quantities of fall-out material associated with military use of atomic weapons in time of war or with accidents involving large quantities of radioactive fall-out material.

"During the past 12 years I have been associated with the problems of fall-out and surface contamination from radioactive materials. I believe these problems can be resolved adequately in time of peace and war if civilian groups such as the Civil Air Patrol are adequately trained and equipped to locate and appraise the hazard."

Equipment Program

Civil Air Patrol is now embarked on a program to develop its radiological survey capacity. Maj. Gen. Lucas V. Beau, who recently retired as national commander of the CAP, reports that its Illinois wing has begun to equip planes in Chicago with radiation detection instruments and to train crews in their use. Similar programs are scheduled for Wisconsin and Oklahoma CAP wings in co-operation with state Civil Defense authorities.

Although these preliminary tests of aerial radiological survey techniques indicate that much improvement is necessary both in airborne instruments and in piloting and communications procedures, they also have shown that the Civil Air Patrol has an opportunity to add a new and vital role to its already substantial repertoire of emergency type operations.

CAP now flys about 62% of the hours devoted annually to air search and rescue in the United States and has been perfecting its technique on disaster evacuation and emergency aid for many years. Among its more spectacular demonstrations of the effectiveness of these operations were the airlifting of 1,700 pints of whole blood into a 900-ft. long athletic field in downtown Washington and the transport of a 16-bed field hospital into the Philadelphia Navy Yard to cope with simulated atomic disasters. All of these operations were conducted with plane types ranging from the smallest Pipers to nothing larger than a Twin Beech.

5,300 Planes

In its post-war period, the Civil Air Patrol has grown to an organization of nearly 90,000 persons including 51,000 cadets. It has 12,756 rated pilots and operates approximately 5,300 planes and 10,000 radio facilities. About 4,800 of its planes are owned by corporations or individuals and include the Beechcrafts, Cessnas, Pipers and Navions that are standard types in the growing fleet of business and pleasure planes. The Air Force has contributed some 500 surplus liaison planes for CAP use.

All of the CAP members serve without pay, buy their own uniforms and pay a large part of the operations costs for their aircraft out of their own pockets. USAF pays for fuel and oil expended by CAP planes on missions specifically requested by the military services.

The CAP cadet program for boys and girls over 15 is one of the most effective operations for keeping alive the airminded spirit of youth that is so essential to maintain our aviation leadership.

It would be hard to find another group in aviation who are providing a more effective demonstration of the utility of light aircraft or a more selfless devotion to the job of helping their fellow citizens in distress.

—Robert Hotz

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